

DOCUMENT RESUME

ED 386 942

FL 023 257

AUTHOR Bush, Michael D.; And Others
 TITLE Interactive Videodisc: the "Why" and the "How."
 CALICO Monograph Volume 2, Spring 1991.
 INSTITUTION Brigham Young Univ., Provo, Utah.; Computer Assisted
 Language Instruction Consortium.
 PUB DATE 91
 NOTE 130p.
 AVAILABLE FROM Computer Assisted Language Instruction Consortium
 (CALICO), Duke University, Box 90267, Durham, NC
 27708-0267 (\$10 plus postage).
 PUB TYPE Collected Works - Serials (022) -- Viewpoints
 (Opinion/Position Papers, Essays, etc.) (120)
 EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
 DESCRIPTORS Authoring Aids (Programming); Computer Assisted
 Instruction; *Computer Software; Computer Software
 Development; Cooperative Learning; *Discovery
 Learning; *Electronic Classrooms; *Hypermedia;
 Instructional Materials; *Interactive Video; Second
 Language Instruction
 IDENTIFIERS *CALICO

ABSTRACT

This monograph presents articles on interactive videodisc technology in language learning, ranging from the importance of a theoretical framework, the transition from theory to practice, getting started, design considerations, hypermedia, discovery environments, authoring software, workstation environments, and a look at the future of optical disc technology. Specific papers include: "Theoretical Motivations for IVD Software Research and Development" (Catherine Doughty); "From Theory to Practice: A Model for an Interactive Videodisc Lesson" (Duane E. Bright, Miguel Verano, and Ruben A. Cubero); "How to Get Started in Interactive Videodisc: A User's Perspective" (Alice Slaton); "Teaching and Learning Languages with Interactive Videodisc" (Mylene Garrigues); "A Systematic Approach to the Design of Interactive Videodisc Courseware" (Carla J. Meskill); "Interactive Videodisc as Hypermedia" (John Underwood); "Language Discovery Environments" (A. Allen Rowe); "Videodisc Authoring Software for Foreign Languages: Evaluating Needs and Features" (Joel D. Goldfield); "CALL/IVD Workstations: Towards a Rationale for Their Use in Cooperative Learning Environments" (Kuan-Yi Rose Chang; Wm. Flint Smith); and "From Interactive Videodisc to CD-XXX: The Future" (Michael D. Bush). A glossary is included. (Contains numerous references.) (NAV)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

Interactive Videodisc: The "Why" and the "How"

Edited by

Michael D. Bush

Alice Skaton

Miguel Verano

and

Martha E. Slayden

"PERMISSION TO REPRODUCE THIS MATERIAL
IN OTHER THAN PAPER COPY HAS BEEN
GRANTED BY

Kerrie
Hudginski

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)"

VOLUME 2
SPRING 1991

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as
received from the person or organization
originating it

☐ Minor changes have been made to
improve reproduction quality

• Points of view or opinions stated in this
document do not necessarily represent
official OERI position or policy

Interactive Videodisc:
The "Why" and the "How"

Edited by

Michael D. Bush,
U.S. Air Force Academy

Alice Slaton
Ventura College

Miguel Verano
U.S. Air Force Academy

and

Martha E. Slayden
U.S. Air Force Academy

CALICO monograph series
Volume 2
Spring, 1991

Interactive Videodisc: The "Why" and the "How"

Copyright © 1991 by CALICO, Brigham Young University, Provo, Utah.

All rights reserved. No part of this book may be copied or reproduced in any form or by any means without written permission of CALICO.

Printed in the United States of America.

Printed by BYU Press.

Foreword

We at CALICO have especially enjoyed the opportunity to work cooperatively with the interactive audio/video special interest group (IAV SIG). We especially want to express our gratitude to Michael Bush of the US Air Force Academy (USAFA) and the work of his co-editors Alice Slaton of Ventura College as well as Miguel Verano and Martha Slayden of USAFA in coordinating the presentations made in this monograph. We are very pleased to feature *Interactive Videodisc: The "Why" and The "How"* as the second volume of our CALICO Monograph series.

We have often talked about ways in which CALICO could be a greater service to our membership as well as to all professionals interested in applying technology to the teaching and learning of languages. In these discussions, the need for more information regarding research, development, and implementation in the area of optical disc technology has been stressed repeatedly. We are confident that this monograph will be a most useful reference consulted by administrators, supervisors, directors of learning centers, professionals concerned with options for utilizing technology in teaching and learning languages, and teachers seeking to enhance their classroom activities and teaching techniques through creative applications of interactive videodisc technology.

The special listing of videodisc programs in the March 1990 issue of the CALICO journal has resulted in more requests for reprints than any other single article of feature published in our journal to date. This monograph presents a variety of topics ranging from the importance of a theoretical framework, the transition from theory to practice, getting started, design considerations, hypermedia, discovery environments, authoring software, workstation environments, and a most insightful look into the future of optical disc technology.

We encourage you to discuss this volume with your students and colleagues and look forward to receiving your reactions to this publication. We also invite you to become a member of CALICO and to affiliate with the special interest groups of your choice.

Frank Otto, Ph.D.

Professor of Linguistics/CAI

Executive Director of CALICO

Acknowledgements

The production of this volume of articles has been very much a team effort. I knew from the beginning that I would be unable to pull it together without significant help from others. I would like to acknowledge the help of two of the co-editors, Alice Slaton and Miguel Verano, who worked from the beginning on determining the direction and scope of the articles. In addition to her editing duties, Alice translated Garrigues' article, wrote an article of her own, and prepared the Glossary.

Marty Slayden, on an Intergovernmental Personnel Act Assignment from Air Academy High School, has worked with us at the Air Force Academy this year as a Research Associate and has helped to such an extent that without her efforts, Frank Otto still might be waiting on us another couple of years from now. She handled the last minute rush superbly!

We also had help from two other colleagues from the Air Force Academy, Jill Crotty and Richard Sutherland. These two colleagues read several of the drafts and provided some excellent feedback. I have also appreciated the unflagging support of our Department Head, Colonel Randy Cubero and our Acting Head this year, Lt Colonel Gunther Mueller.

It is also perhaps important to acknowledge the technology that has permitted us to produce a work with suitable neatness, readability, and face validity. Without microcomputers, powerful word processing software, scanners, and laser printers we would not have been able to get as much done as quickly as we have. We received some of the articles on floppy disk, some via electronic mail, and some were scanned from hard copies produced on other computer systems. Text and graphics were integrated using Microsoft Word for Windows and printed using a Laserjet III.

Finally, I must recognize the work of each of the contributing authors. Is it trite to say that without them we would not have had much? Because it was not always easy for us to communicate the specific directions we wanted each article to take, we had to go back to each author for at least one re-write. I realize how difficult this was for them and appreciate very much their willingness to stick with us. Their patience (mostly waiting for me) has also been greatly appreciated.

Thanks team!

Michael Bush

Preface

When Dr Frank Otto, Executive Director of CALICO, first approached me concerning this volume of articles, we discussed the possibility of covering both interactive video and audio. After some thought and discussion we decided to restrict coverage to interactive videodisc (IVD). There are two reasons that I pushed for this. On the one hand, I felt that if both were to be covered, my knowledge of interactive audio was insufficient to do justice to the task. On the other hand, I felt strongly that IVD has significant advantages over alternative technologies and therefore was worthy of our full attention. This reasoning on the qualitative advantage of interactive videodisc can be summarized in two areas.

First, in comparing interactive video to interactive audio, it seems obvious that the visual element is extremely important not only in conveying meaning but also in the development of memory structures for efficient recall. This reasoning contrasts with the ideas of some writers who have treated interactivity as the primary characteristic of interest for the capabilities of videodisc in foreign language instruction. Although interaction is certainly a major element of IVD-based instruction, the close relationship between the visual element and comprehension and memory is an important additional capability that adds to videodisc's inherent advantages and requires serious consideration for implementation in the language learning process.

Second, when considering interactive videotape and interactive videodisc, I feel that the speed advantage of videodisc enables such quick access to materials that it constitutes a potentially significant qualitative advantage over interactive videotape. With videodisc the student can quickly review utterances or access related examples. The access speed of interactive videodisc allows students to repeat utterances or to review precise passages, increasing their time on task by removing a significant percentage of the wait time that would be required with videotape.

Some individuals, perhaps arguing that the high price of videodisc limits its use, might call for the coverage of videotape in such a volume as this. Although this price differential exists at the present time, many industry experts feel strongly that there are several candidates among current compact disc technologies that will soon be able to provide the capabilities of interactive videodisc at an increasingly affordable price. Indeed, because the development costs for materials to be delivered via any interactive medium are so high, it seems clear that large markets must develop if materials developers are to be able to recoup their investments. There should be no question that the technology that can best address the needs of the mass market will be the winner for the developers' attention.

Thus it becomes important to consider appropriate forms of interactive activities that transcend all possible interactive delivery systems rather than being preoccupied with the question of which delivery system is ideal for all applications. The challenge that falls to the members of the foreign language education profession is to derive the means (discover the whys and wherefores and develop the wherewithal) to exploit inexpensive interactivity when it becomes available, no matter the delivery platform.

This volume, therefore, is an attempt to help make this possible. It focuses on interactive videodisc because that is the most powerful, the most mature, and the most widely available technology today. The principles of interactivity, however, apply to all platforms, those currently available or others planned for the future.

Doughty's article was written to provide in general a theoretical basis for the use of interactive videodisc in language learning and in particular a theoretical basis for using interactive videodisc as a platform for research on language learning. At the Air Force Academy we often tell visitors that we have more questions than answers about how to most appropriately use interactive videodisc. The limited number of answers is a reflection of how little is definitely known about how people learn language. Doughty explains how the act of learning more about videodisc will not only be useful in language education, but will also provide knowledge that can help in actually understanding how people learn language.

The second article helps show the connection between what makes sense theoretically and what can be done to make a particular type of videodisc material interactive. Bright, Verano, and Cubero provide a rationale for taking a specific approach to the practical use of IVD technology in lesson design and delivery.

Next, Slaton provides a personal case study on what she did to get started in interactive videodisc. Beginners will learn a lot of valuable information from her experiences and may appreciate her explanation of possible stumbling blocks in the development of IVD projects.

Garrigues' article introduces the reader to some of the early work in videodisc that was done in Paris at the World Center for Human Resources and Informatics as well as in a few other projects in France. She focuses on how to use IVD to its best advantage, ie. promoting listening comprehension and providing a realistic cultural environment for language discovery.

Implementing good instructional design is an objective of every interactive videodisc project. Meskill describes a methodology for approaching the central design and development issues that each developer will find useful.

Hypermedia is a common buzzword in education and in the microcomputer world in general. Underwood provides readers with an overview of hypermedia concepts and shows how interactive videodisc implements many of these. He provides some good examples of the concepts he introduces using Hypercard on the Apple Macintosh as a representative delivery system.

Rowe presents the notion of providing environments to language learners in which they can experience and learn language through discovery. He shows how many of the concepts he proposes relate to current language learning theory. In his unusual and innovative way, he elaborates on the question of language learning vs. acquisition by translating concepts into formulaic terms. Readers will gain new insights from this fresh perspective.

Any language education professional who wants to get involved in developing interactive videodisc materials must face the concept of authoring systems. Goldfield introduces several important concepts of authoring and materials development and shows how several systems relate to these concepts.

Demonstrating how interactive videodisc can be used as a research vehicle, Chang and Smith describe research into cooperative learning in an IVD setting.

In line with the concept of universality for many types of interactivity, the final article of this volume will compare and contrast videodisc and the most prominent compact disc technologies.

All in all, there should be something in this volume for a wide range of readers. The articles herein present a variety of different styles and approaches. Some elements are basic and some are technical and thus hopefully the collection addresses a wide spectrum of needs.

Michael Bush
United States Air Force Academy
13 March 1991

Table of Contents

Foreword	
Frank Otto.....	i
Acknowledgements	
Michael Bush	iii
Preface	
Michael Bush	v
Theoretical Motivations for IVD Software Research and Development	
Catherine Doughty	1
From Theory to Practice: A Model for an Interactive Videodisc Lesson	
Duane E. Bright, Miguel Verano, Ruben A. Cubero	17
How to Get Started in Interactive Videodisc: A User's Perspective	
Alice Slaton	25
Teaching and Learning Languages with Interactive Videodisc	
Mylène Garrigues	37
A Systematic Approach to the Design of Interactive Videodisc Courseware	
Carla J. Meskill	45
Interactive Videodisc as Hypermedia	
John Underwood	63
Language Discovery Environments	
A. Allen Rowe.....	73
Videodisc Authoring Software for Foreign Languages: Evaluating Needs and Features	
Joel D. Goldfield.....	89
CALL/IVD Workstations: Towards a Rationale for Their Use in Cooperative Learning Environments	
Kuan-Yi Rose Chang and Wm. Flint Smith.....	101
From Interactive Videodisc to CD-XXX: The Future	
Michael D. Bush	111
Glossary	
Alice Slaton	119
Editors and Contributing Authors	
Martha E. Slayden	125

Theoretical Motivations for IVD Software Research and Development

Catherine Doughty

University of Sydney, New South Wales, Australia

"CALL, in and of itself, does not result in more and better learning; rather, it is the specific way instruction is coded in CALL software that has the potential of affecting learning positively, for specific learners in specific contexts."

--Pedersen, K. (1987), p. 107.

Introduction

It is important to recognize that language learning within the new technological environment of interactive videodisc (IVD) is primarily language learning and secondarily IVD language learning. While the IVD workstation provides a context for language learning, the IVD software may (or may not) affect the language learning process, depending upon how the software is coded. The crucial question, then, is how to best code IVD instructional software to utilize the available features of an IVD workstation environment for effectively promoting language learning.

The answer to this question can only be determined via a rigorous research and development program that explores the potentially advantageous features of the IVD context for language learning from the perspective of second language acquisition (SLA) theory. In addition to providing direction for the development of instructional software, the value of such a research and development program is that IVD-mediated research may make a substantial contribution to accumulating empirical knowledge about the complex process of language learning, which researchers are only just beginning to understand in a way that has any scientific validity.

In light of the above considerations, three important points should be brought to bear on the question of how best to develop IVD software:

1. Instructional design should be informed by theory and findings from second language acquisition research;
2. in the interest of both SLA theory and second language teaching practice, IVD materials development should routinely incorporate empirically based research.
3. technologically-mediated research should be recognized as providing the inherent advantages of easily controlled experimental designs, convenience of data collection, and permanence of experimental treatment records.

The first step toward establishing a program that will be mutually beneficial to empirical research and to software development is the identification of those features of the IVD environment that suggest that it may provide a facilitative context for second language acquisition. These features should neither be proposed at random nor because they are examples of innovative technology. Rather, the potentially beneficial aspects of the IVD context for language learning should emerge from a consideration of existing IVD capabilities within the perspective of recent SLA theory. Thus, the aim of this chapter is to present a contemporary perspective on second language acquisition, from which several potential advantages offered by the IVD language learning environment will be hypothesized.

At a time when applications of technology to language learning are more driven by advances in technology than motivated by language acquisition research, it is crucial that these considerations be taken into account.¹ The proposal to support IVD software development with a program of language acquisition research and development is promising because the IVD technology itself is flexible enough to allow software developers and researchers to build from and contribute to SLA studies simultaneously and cyclically.

Approaches to Second Language Acquisition Theory Building

In all contexts of language acquisition, two important factors are essential: a normal human brain and language input in the environment. There is no disagreement among scholars that both are necessary for language acquisition to take place. First, evidence has shown that in cases of brain abnormality language ability does not develop, or, in the case of brain injury, language may be lost. Secondly, input is considered to be necessary to acquisition on the basis of documented cases of child language acquisition that has been delayed in the absence of input (cf cases of deaf children of non-signing parents, Sachs & Johnson, 1981; and cases of severe child abuse, Curtiss, 1977).

The debate on how to best explain the process centers upon the nature and extent of the role of input in language acquisition. From the discussion in this chapter, it will become apparent that SLA research within the IVD environment may provide special insight into both the role of input and the learner's contributions to language acquisition. For now, the discussion turns to a brief, chronological consideration of these three general theoretical approaches to understanding language, input, and second language acquisition.

The relative contributions of the human innate capacity for language learning and the input from the linguistic environment have been examined from three perspectives: behaviorist, nativist, and interactionist (Ellis, 1986). From the well-known behaviorist perspective of mid-century, the role of input was incorporated into the stimulus-response-feedback (SRF) model of learning. The learner's interlocutor was seen as the stimulus-input provider, and the learner was said to produce target language in response to the stimulus input. Thus, the process of language acquisition was seen as the internalization of input through imitation of the stimuli. Feedback, also provided by the interlocutor, was considered necessary as reinforcement for successful internalization of input leading to permanence of the structure in the developing grammar, or, alternatively, as a shaping process for correction of inaccurately or incompletely internalized stimuli.

The behaviorist view of language learning has been largely discounted in two ways. First, it has been proposed that the task of learning a language through imitation of stimuli is an impossible one and that viewing language learning in this way does not account for every speaker's creative ability to produce and understand novel sentences (Chomsky, 1957). Additionally, child language acquisition research has shown that while imitation of adult utterances can be observed in child language data, the percentage of the overall speech of the child, which involves imitation is very small.

IVD software development may take a first lesson from the contemporary perspective on behaviorism and language learning. SRF patterns are abundant in non-technologically mediated language teaching materials in the form of notorious drill and practice activities, ALM pattern practice, and misguided concern for preventing or extinguishing errors (i.e., "bad habits"). Though machines are consummate and tireless drill masters, there is no empirical evidence to date which suggests that such a format is appropriate for language learning. Furthermore, in contemporary SLA theory, errors are seen as healthy indicators of learner progress in acquiring the target language. At this point in the understanding of SLA, such errors should be documented and studied as windows into the language acquisition process rather than responded to or corrected in some way through the software. Learners may be guided to discovering their own errors through various help options made available (but not imposed by) the IVD software. Perhaps the emphasis in software design should be placed on tailoring IVD materials to suit the requirements of the learner's natural ability for language acquisition postulated in the nativist position on language learning.

¹It might be noted that, since IVD software development is expensive, this is a very practical argument for proceeding cautiously and from a strong empirical base.

From the nativist perspective on language learning (Chomsky 1957, 1965), environmental language input is taken to be a trigger which activates the innate language learning process. Thus, while input is necessary to trigger language learning, learner internal mechanisms (known collectively as the Language Acquisition Faculty [LAF], (Chomsky, 1981) are more important, in that they guide acquisition via universal principles. Thus, from the nativist perspective, the role of input is considered to be minimal (though necessary), and the role of the learner's natural ability to learn language is given priority. Discovery of which aspects of language are guided by the learner's internal mechanisms and what kinds of triggers are necessary to activate the natural acquisition process could provide IVD software developers with vital information on how to code the structural content of language instruction materials. Although empirical research of this nature has only recently been of interest in SLA theory, several areas of linguistic ability have been shown to be resilient in the absence of input. Morphosyntactic areas of language, such as syntactic ordering rules, constituent construction rules, recursion, and major semantic notions like "action" are likely candidates for innate determination (Goldin-Meadow, 1982, Johnson and Newport 1989). Closed class items, movement rules (such as question formation), and some morphological features (such as past tense, plural, and 3rd person singular marking in English), on the other hand, are subject to environmental influence and may require more explicit attention to be acquired successfully. What is needed now is the investigation of triggers to stimulate more rapid development of universal areas of language (if indeed this is possible) and a better understanding of how environmental input influences non-universal aspects of language development.

In contrast to the two extreme, polarized views characterizing the role of environmental experience (behaviorism + input) vs. linguistic universals (nativism + LAF) in language acquisition, a third view of language acquisition has emerged--the interactionist perspective. The interactionist account reminds us that the acquisition of language results from a reciprocal relationship between the human innate capacity for language learning and the language data available in the input. The input affects the innate mechanisms, which, in turn, are influenced by the input to which they are exposed. To date, interactionist SLA studies have admittedly focussed more on the input than on the internal input processing. Much painstaking and necessary descriptive work has been undertaken, in a variety of linguistic settings, to provide a basis for generating hypotheses relevant to how the input might be internalized into the developing second language grammar (see, for example, Hatch 1978a, 1978b; Long 1980; Pica and Doughty 1985). It has been shown that second language learners actively strive to comprehend input for the purposes of communicating with interlocutors or of understanding information in situations such as reading or watching television. Thus, the process of comprehension of input has also been studied extensively in light of theoretical views that comprehension of the message contained in the input is a necessary prerequisite for the internalization of structure of the input (c.f. Chaudron 1983, Doughty and Pica 1986). It is hypothesized that, in addition to exposure to input, comprehension of input is relevant to language acquisition. Most recently, research attention has focussed on the interaction which ensues when input is not comprehended in an effort to discover how learners and their interlocutors might modify their speech or request modification of the speech of the discourse partner (c.f. Long 1985, Pica, Young and Doughty 1987).

The interactionist perspective on SLA provides a promising theoretical underpinning for research and development of IVD software for language learning. If language learning is seen as a regular and ongoing interaction between the learner's mental abilities and the linguistic environment, each contributing to language acquisition and each influencing the other, then the interaction between learner and the auditory and visual environment created in the IVD context may be hypothesized as facilitative to the second language acquisition process.

Focus on input, what the learner does with the input, and how input becomes a part of the IL grammar and is ultimately revealed in the learner's output are all important research questions which could be examined in an IVD research and development program. The most obvious advantage of IVD as a research environment is that the influence of the context and the input on second language acquisition can be documented: the linguistic context, the physical (visual/auditory) context, the epistemic (knowledge/information) context, and the sociolinguistic context can be taken into consideration simultaneously. In this way, researchers may deal with the difficulties of empirical observation much more capably than ever before. Permanent records of all of the input to learners during experimental sessions-- the visual input, the auditory input, the linguistic input, the content of the input-- and documentation of the learners' reactions to the input can be kept. Further, input and reactions to input may

also be examined in light of the context of the input. Ultimately, such observation must be combined with second language assessment measures (another area to which IVD research can contribute), so that observation of behaviors, input, language comprehension and production may be integrated to facilitate the study of second language acquisition.

Goals of a Theory of Second Language Acquisition

Second language acquisition (SLA) researchers are interested in understanding how language is acquired in general, and how languages other than the native language are acquired in particular. At the level of language, research has centered upon determining the relationship between the first language (L1) and the second language (L2) during acquisition, as well as on describing the structures and functions of the evolving interlanguage, which is now considered to be a rule-governed linguistic system (rather than an imperfect form of the target language, as had been the case with the behaviorist perspective). In short, the aim is to understand the SLA processes underlying a learner's increasing ability to use the linguistic systems of the target language as they develop in the newly evolving interlanguage grammar and for the purpose of communicating or deriving meaning with/from interlocutors and texts.

While language acquisition by both adults and children is studied, adult second language acquisition is seen to pose greater cognitive difficulty and to be far less successful than first or even second language acquisition by children. Perhaps those professionals who work with adult second language learners stand to gain the most from the articulation of a theory of SLA. The cognitive contributions of the learner form a vital component of the overall theory, and learner variables and characteristics are evaluated at cognitive and social levels.

Throughout the 1980's, second language acquisition researchers worked toward an increasingly more sophisticated approach to the investigation of the hypothesized cognitive processes that comprise language learning. Observations have contributed to the development of theoretical models, results of continuing research efforts have served to alter and refine the theoretical models, and professional journals enable dissemination of research findings internationally. The primary goal of researchers is to formulate a general theory of second language acquisition that will be informative and applicable by all second/foreign language professionals (Spolsky, 1989). The theory must then consider observed behaviors and data generated, in turn, by the empirical research that was motivated by the theoretical models (which may then have to be revised). The role of the learner, the nature of the language to be acquired, the influence of the context of acquisition, the cognitive processes involved in language acquisition and use, and, perhaps eventually, the physiology of the brain itself with respect to language function (especially in comparison to other cognitive functions) are all central concerns for theoretical model builders. Finally, any theory of language acquisition will have to account for empirical findings to data (Long, 1990).

While certainly recognizing the influence of the relevant linguistic systems of the target language and the significant contribution of the learner herself to language learning, much of the recent empirical investigation has been directed toward understanding hypothesized acquisition processes by holding constant target language and learner variables. Generally, interactionist SLA theory holds that at least some of these processes are: perception of, attention to, and comprehension of input; internalization of the phonemic, semantic and morphosyntactic systems presented in the target language input; and, of course, the resultant ability to use the target language as measured in the learner's production. In other words, acquisition involves at least three phases: (1) apprehension of the target language input; (2) internalization of the structures and comprehension of the content of the input; (3) subsequent production of the target language structures in the same and in new contexts of use.

The empirical findings that have been generated through the cycle of theory building--research--theory refinement and that have addressed the above concerns of SLA research (e.g., understanding the influence of the target language, the cognitive role of the learner, and the nature of TL production) can be applied toward determining the best coding elements for IVD software. Important decisions about how to segment and present the target language within the IVD environment, which elements of control should be assigned to the learner and which left to the software, and the determination of IVD techniques that facilitate the SLA processes of input comprehension, structure internalization, and resultant target language production capabilities should be

considered in light of the theoretical and empirical work to date. In view of the promise of the interactional approach to developing IVD software and keeping in mind the above goals of a theory of SLA, the discussion now turns to a consideration of two models of SLA, some empirical findings of research generated by these models, and what such findings might suggest for a comprehensive IVD software research and development program.

Models of Second Language Acquisition

At the current state of the art of the research, it must be conceded that language acquisition is a phenomenon that cannot be observed directly; consequently, researchers must construct theoretical models based upon language behaviors that can be observed. Theoretical models, in turn, motivate organized empirical investigation leading to more data pertaining to the overall phenomenon of acquisition. Some of the behaviors that are directly observable in classroom language acquisition research are: learner actions (e.g., movements, selections), the target language input made available to learners by interlocutors or by text (e.g., conversation and reading), and the target language used by learners (e.g., oral and written production). That a learner has acquired some aspects of the target language is assumed in cases where, after a period of exposure to and comprehension of the target language, the learner demonstrates the ability to use new (i.e., previously unobserved) aspects of the target language productively.

In other words, the process of second language acquisition must be inferred from the observable behaviors of language learners during comprehension and subsequent production of the target language. It is natural, then, that observations of target language comprehension and production have been central to empirical research on SLA, and such findings have formed the basis for several contemporary models of language acquisition. However, learner behaviors themselves are difficult to observe since they occur in rapid succession and are ephemeral. Elaborate research techniques involving investigator observation and field notes have yielded some valuable information about the process of language acquisition, but such research is laborious and is probably biased by the presence of the researcher. The IVD context of language learning and SLA research, on the other hand, provides the advantage of permanence of records and of enabling unlimited time for subsequent analysis. Specifically, through session logs and learner logs, all of the input to learners (visual and auditory), the learners' actions on or to the input, the learners' behaviors, and the learners' output can be captured for later observation. The visual and audio input with which learners interact during any particular IVD session can be replayed by researchers who can then analyze earlier learner responses to the very same visual and audio input environment.

Many models of second language acquisition, incorporating SLA processes, learner and contributions, and target language structure and rule development have been constructed. All of the theories and models cannot possibly be reviewed here. For the purpose of determining how best to code IVD software, it is perhaps best to examine the models which fit well with the capabilities of the hardware. Visual and auditory contextualization and the ease of combining videodisc segments with computer-controlled presentation of target language and instructional materials suggest that IVD materials developers might concentrate on understanding how these coding elements facilitate the comprehension of second language input. Thus, comprehension-based models of SLA may offer the greatest insight to IVD researchers and materials developers.

The Input Hypothesis (from Monitor Theory) has had a powerful impact on comprehension-based SLA research as well as on classroom practices (Krashen 1980, 1982). Based upon the observations that language acquisition does not proceed in the absence of input and that learners actively seek to comprehend input, the Input Hypothesis holds that "a necessary condition to move from state i [i.e., current interlanguage ability] to state $i+1$ [i.e., control of linguistic structures just beyond the current psycholinguistic processing level of the acquirer] is that the acquirer understand input that contains $i+1$ level input, where 'understand' means that the acquirer is focused on the meaning and not the form of the message" (Krashen 1977, p. 21). In other words, in order for acquisition to proceed, the acquirer must somehow understand the semantic content of input whose linguistic structures are slightly beyond the acquirer's current level of interlanguage development.

Two theoretical SLA models that have attempted to explain more precisely the processes that comprise input comprehension and/or target language internalization are the Negotiated Interaction Model of SLA and the

Cognitive-Processing Model of SLA. The Negotiated Interaction Model, an approach to the study of language learning that has evolved from developmental psycholinguistic research, addresses the question of what makes input comprehensible during conversational interaction between native and non-native speakers (i.e., input providers and input consumers). The Cognitive-Processing Model, has been adapted from cognitive psychology, where it is used to explain concept, information and/or skill learning. This model, as applied in SLA research, is chiefly concerned with the interrelatedness of linguistic knowledge and world knowledge as each functions to facilitate the comprehension and internalization of the semantic and structural components of target language input.

Both of these research approaches, as applied to SLA theory, seek to specify further the Input Hypothesis of Monitor Theory in such a way that the hypothesis may systematically be investigated. The Negotiated Interaction Model of SLA is mainly concerned with the identification of specific features in the input that facilitate comprehension and in establishing empirically the link between comprehension and acquisition. The Cognitive-Processing Model primarily addresses the processing of the input in terms of comprehension, storage (e.g., memory) and retrieval. Consequently, the processes by which world knowledge information and linguistic information are stored and organized in memory and by which access to stored information is gained during target language production are also central concerns of the Cognitive-Processing Model of SLA. Empirical findings of studies generated by these two models will now be presented together with a consideration of the implication of the findings for IVD software research and development.

The Negotiated Interaction Model of SLA

Soon after the impact of the Input Hypothesis, which defined a central role for comprehension in acquisition, the claim was made that a learner's comprehension of unfamiliar input is best aided when interlocutors modify their utterances during conversation in order to communicate the meaning of their messages (Hatch, 1978; Long, 1980, 1985). Theorists hypothesized that input becomes comprehensible to the second language acquirer through these modifications in the interactional structure of conversations between native and non-native speakers (NS and NNS), which arise out of a need to repair breakdowns in communication. Recent studies, therefore, have concentrated on the discourse analysis of interaction among L2 learners engaged in a variety of classroom tasks. In general, subjects perform tasks that require an exchange of information among all participants in order for the task to be completed. The research focuses on interactional moves which serve to specify meaning, such as clarifying, requesting clarification, confirmation of hypothesized meaning, repetition of one's own or another participant's utterances, and so on. These moves have been shown by research to be instrumental in comprehension. Interaction among interlocutors which employs such moves to repair communication breakdowns is known as negotiation or negotiated interaction. Negotiation is defined as a mutual activity in which interlocutors, i.e., speakers and listeners, clarify their own and each other's utterances in their efforts to communicate (Pica, 1987).

Working within the framework of the Negotiated Interaction Model of SLA, Pica and Doughty (1985) and Doughty and Pica (1986) initially sought to describe negotiated interaction as it occurred during various classroom activities and in several different participation patterns. Task type (e.g., values clarification discussion and information exchange tasks) and participation patterns (e.g., teacher-directed activities and small group tasks) were manipulated while the negotiated interaction that took place under each condition was described, quantified, and compared across groups. Interactional modifications that had been hypothesized to comprise negotiation were documented in these studies (Long, 1980). Pica and Doughty found that, optimally, learners should be engaged in information-exchange activities, either with their teachers or with other students, to promote the greatest quantity of negotiation features. This research, thus, has provided both description and quantification of negotiation; however, Pica and Doughty did not show directly that target language comprehension is the result of negotiated interaction. In other words, while it was clear from the data that there were breakdowns in communication during attempted information exchanges, and that, subsequent to communication breakdowns, learners and their interlocutors engaged in negotiation, it was not demonstrated that learners comprehended the input as a consequence of modifying their utterances during the negotiation of meaning. The next step, therefore, was to build precise measures of comprehension into the research design. Consequently, Pica, Doughty and

Young (1986) and Pica, Young and Doughty (1987) subsequently initiated two more studies which operationalized comprehension through the use of videotaping techniques. These measures enabled them to connect the target language input with learner actions during an information exchange task. The subjects were videotaped while performing actions in response to task directions given by a native speaker. Whenever the task direction was not carried out, it was noted that the subject had not comprehended the input. When, however, the task direction was followed accurately, subjects were said to have comprehended.

Previously, research had shown that simplified input facilitates comprehension (Chaudron, 1983). In the Pica et. al. (1986) studies, however, two conditions of input were compared: premodified (i.e., simplified) input with no opportunity for interaction was compared to the condition of unaltered input with the opportunity to interact. In the premodified input condition, the native speaker read each task direction and did not allow the subjects to say anything while performing the necessary actions. In the interactional condition, the native speaker read the corresponding baseline (i.e., unmodified) direction, but also allowed the subjects to ask questions or make any kind of statement at will. Results indicated that subjects who participated in the interactional condition were more successful at following the task directions than were subjects who heard only the premodified, simplified directions. Additionally, within the interactional condition itself, where there was an initial failure to understand the baseline task direction and then eventual success on the task direction, the intervening interaction between direction giver and direction receiver was shown to incorporate the features of negotiation that had been identified in earlier research. From these findings, the researchers concluded that negotiation leads to comprehension.

In sum, much research has been stimulated both by Krashen's earlier claim that comprehension is necessary to acquisition and by the subsequent explanatory claim that negotiation provides the specific mechanisms that facilitate comprehension. Through these research efforts, some precise ways in which learners and their interlocutors modify their interaction toward comprehending input that was initially opaque to them have been documented, and it has also been established that through negotiated interaction comprehension of native input by non-native speakers is indeed achieved. The empirical findings of studies seeking to describe the features and document the effects of negotiation have been quite consistent in pointing to the facilitative role of negotiation in comprehension (see Chaudron, 1988 for a review).

The Negotiated Interaction Model and the Interactive Videodisc Environment

As noted at the outset of the chapter, the crucial question for interactive videodisc is how best to code the software to promote language learning. SLA theory recognizes the importance of comprehension to acquisition and recently, through the Negotiated Interaction Model, has tried to identify some of the ways in which input that is not initially understood eventually becomes comprehensible. The research reviewed above suggests that materials developers should concentrate on creating tasks that push learners to interact with language input that is not already comprehensible to them. In this way, learners will have to negotiate meaning during the completion of the task. In the videodisc environment, learner options that make available on-line the kinds of resources available during conversational interaction are potentially advantageous to SLA. The exchange of information (i.e., content information) between learner and software could be one requirement for the completion of the computer-generated task in order that the learner be pushed to function at this level of interaction. Care must be taken in the coding of software elements to provide a need to comprehend. In a study comparing the interaction among learners working on a computer task to the previous findings on non-computer tasks, which generated interaction among learners, Mohan (1987) found that the computer tasks encouraged less interaction than had been the case with non-technologically mediated tasks. Perhaps this unexpected finding may be explained by the excellent capacity of the computer to provide context for language. In other words, when all the input is initially comprehensible on a computer--i.e., when learners comprehend all the language and activities on the screen--there is no need for negotiation. IVD materials developers should balance contextualization with the need to push learners to understand difficult target language material that is not readily comprehensible.

The flow and residence of information pertinent to task solutions are also important coding elements of IVD software. If the videodisc provides input, the comprehension of which is necessary to the completion of the task, ideally, the learner should also hold some of the information necessary to the completion of the task. For example, a computer-generated information gap task could be an adaptation of solving a mystery. At the outset of

the task, the learner could be provided with one clue to the solution of the crime. The videodisc could provide the learner with access to descriptions of the other various elements of the crime, at the control of the learner. Whenever the learner failed to understand any video segment, he or she could choose from among a variety of resources available to negotiate the meaning of the clue. In conversational interaction, negotiation is characterized by moves which specify the meaning of the utterance that was not initially understood. Some routine negotiation moves (several varieties of each) could be hypothesized as effective in the IVD environment and created using the authoring system and a variable key element, and such resources should be available to the learner via function keys. Research is needed in order to determine which aspects of negotiated interaction are feasible and effective in the context of IVD language learning. Another suggestion would be to segment a task so that comprehension could be assessed throughout its completion. If the program detects a lack of comprehension then the negotiation of meaning could be initiated from within the videodisc environment. In this way, the framework of the task solution could be somewhat guided. Eventually, when computer-adapted testing and valid interlanguage development measures become available to researchers, the "i+1" construct may be operationalized in terms of the structure of the target language, rather than simply comprehension of the content of the input. This next step in the research is absolutely necessary to an understanding of acquisition. Once again, it may be noted that technology facilitates this kind of empirical measurement in a way never before available to researchers.

The Cognitive-Processing Model of SLA

The Cognitive-Processing Model of SLA, based on general learning theory, emphasizes the cognitive functions that underlie comprehension, memory and learning. Within the cognitive approach to the study of SLA, language learning is considered to be analogous to the learning of any complex knowledge.² Like the research on negotiated interaction, the research on cognitive processing has tended to focus on comprehension; additionally however, this research addresses questions of the retention of comprehended information in memory (demonstrated through recall or through ability to use learned information in problem-solving situations). It is often difficult to separate general learning issues from language-specific learning issues because language is the embodiment of the information that is to be learned in the more general learning experiments. In other words, in much of the research, the target of investigation is one of many language aspects such as vocabulary and comprehension, but the focus of the research is on the cognitive processing of the information that is conveyed through language, rather than on the acquisition of the language structures themselves. This issue will be explored further at the end of the chapter.

The Cognitive-Processing Model of SLA emphasizes the mental representation of information and how it is processed during internalization and retrieval. The mental representation of the information, or knowledge, is also seen both to affect as well as to be affected by incoming information. An early version of this perspective was espoused by Ausubel (1968), who posited that, in meaningful learning, already known ideas serve to anchor new propositions encountered in texts.³ Ausubel also claimed that "advance organizers" could be developed in classrooms to serve this function and thereby facilitate learning. More recently, these ideas have been incorporated into the Schema Theory of human cognition (in particular, with reference to reading) (Rumelhart, 1977). A schema is a known framework of background knowledge which exists in the learner's brain. Schemata are claimed to facilitate the assimilation of new information. For example, studies have shown that subjects recall sentences related to known information ("The fat man read the sign warning of thin ice") better than sentences related to unknown or irrelevant information (e.g., "The fat man read the sign that was two feet tall") (Bransford, 1983).

Schema Theory has influenced many areas of education from reading to math to foreign languages, and its constructs have been applied to the investigation of the nature of knowledge in many fields (Bransford, 1979). In general, Schema Theory aims to characterize human knowledge of the world. When applied to questions of SLA, schemata are postulated to regulate the processing of linguistic input, and, as noted above, incoming input serves

²This analogy, however, is by no means yet proven.

³"Text" may be understood in its general sense rather than its restricted meaning of "written text."

to restructure the mental representation of the target language already in storage. The constructs of Schema Theory have primarily been applied to the investigation of comprehension. Comprehension is said to consist of (1) finding a schema that seems to fit the input, (2) discovering the particular entities in the input that correspond to the roles in the schema, and (3) making inferences to fill in the gaps. This process may be particularly difficult for second language learners since they often lack both relevant knowledge schemata and necessary cultural and linguistic schemata.

The Cognitive Processing Model and the Interactive Videodisc Environment

A number of recent IVD experiments conducted by Bransford and colleagues using native-speaking subjects shed light on the role of visual and textual context in the comprehension of information, the ability to understand sentences, and the learning of vocabulary, at least for competent native speakers (see Bransford et. al. 1989 for a review). In each experiment, the aim was to provide a context of instruction that incorporates mediators of the kind that are found in natural learning contexts (in particular, in "havens" for learning encountered by children). According to Bransford et. al. (1989) mediators,

...arrange environmental conditions and provide feedback and instruction that is uniquely suited to the performance level of the child. Mediators also help children recreate mutually familiar contexts so that discussion and instruction can move readily take place. In addition, they help children transform facts and procedures into useful conceptual tools (p. 20).

In the one experiment using the video of a familiar film, *Swiss Family Robinson*, two groups of undergraduate subjects were tested on their ability to (1) comprehend propositionally complex sentences (e.g., "The pigs were safe because the barrels were tied together." [in the film, animals were floated to shore from the shipwreck]), (2) infer the meaning of nonsense words (e.g., "the Lel was in trouble so they needed to reach the Gek." [in the film, family went ashore because the ship was just about to break apart]), (3) generate inferences that provide coherence between not-overtly-related sentences (e.g., "The rope slipped. Mother's hair was wet." [in the film, Mother falls into the ocean when a rope lowering her to the raft slips]), and (4) recall topic names from list of 30 topics which they had rated for interest-level in possible lesson for fifth graders (e.g., courage, why wood floats, sharks, etc). All four tasks were based upon the information contained within the first 25 minutes of *Swiss Family Robinson*. One group--the film-viewing group--saw the film before attempting the tasks, while the other group--the non-viewing group--simply were given the four tasks to accomplish. Not surprisingly, the film-viewing group outperformed the subjects who were not provided any context for the comprehension, inferencing and recall tasks. The researchers concluded that the richness of the video context enabled the film-viewing subjects to comprehend the difficult sentences, make appropriate inferences between and within sentences, and even provided a common theme for recalling items from a list of film-related topics.⁴

Another experiment compared two groups of sixth grade students on their ability to answer comprehension questions under three conditions: (1) prior video context, (2) prior video and textual context, and (3) prior textual context only. The video was the same segment of *Swiss Family Robinson* discussed above, and the text was a related story, written approximately at the children's reading level. Groups 1 and 2 saw the same video, and groups 2 and 3 read the same text. Two kinds of questions were asked of all subjects: the first pertained to part one of the text, which was closely tied with the action in the video; the remaining questions related to events in part two of the story, which essentially picked up where the video ended and contained new and different, though thematically related action. Results of tests of comprehension of questions pertaining to the action in the video vs. the written story showed that information presented in the video context is more readily comprehended than is information presented only in textual context. Results also showed that subjects receiving both video and textual context were best able to answer the comprehension questions. As the researchers point out, this finding could be due to a redundancy factor as essentially the same information was presented in two contexts for the video +

⁴There is a serious methodological difficulty with the third task, because researchers counted as correct only those inferences between seemingly unrelated sentences which reflected the themes of the film. Of course, this criterion is biased in favor of those who saw the film; those subjects who had not seen the film would not be expected to be able to infer the correct relationship between sentences like, "The rope slipped. The mother's hair was wet."

story group. However, results of those questions testing comprehension of information contained only in the written story suggest that redundancy was not the sole influential factor. The group which viewed the video and read the text performed better than the group which only read the text; and, the group which only read the text performed better on the comprehension test than the group which only saw the video. The latter finding would be expected, since the information which formed the basis of the questions was only available in the text. However, the more interesting finding is that subjects who viewed the video and read the text performed the best on the second comprehension test, despite the fact that the video itself did not contribute any specific information needed to answer the questions. Bransford et. al. (1989) concluded that there may be a synergistic relationship between prior video context and text.

The Cognitive-Processing Model was originally developed to model the learning of content information rather than specific aspects of language. Several questions arise as to whether language structures are learned in the same way as other types of complex knowledge and how the mechanisms specified by Schema Theory apply to second language acquisition. Studies of reading in a second language have addressed these questions, and findings indicate that, while the constructs of schemata and schema-activation are relevant to questions of language acquisition, second language learners may not be expected to behave in ways comparable to native speakers of the same target language. In one study, Carrell (1988) found that NNS who had demonstrated that they possessed the appropriate schema (teeth-brushing) on a pre-test measure, nevertheless were not able to comprehend the information within a text on brushing teeth. Carrell suggests that L2 readers are overwhelmed by the decoding requirements of reading in a second language and, therefore, are not able to use higher level cognitive skills such as schema activation. Carrell also indicated, however, that subjects reported thinking they "were not supposed" to infer meaning from the text when answering comprehension questions, but rather were expected to find the meaning in the literal text. Again, second language readers appear to focus unnecessarily on the form of the language rather than its function. Interestingly, however, in the studies of NS college students, Bransford et. al. (1989) found that, unless explicitly told to do so, subjects were not likely to take advantage of any advance information or context provided to them. So, the difficulty may not be entirely L2-oriented, but rather may be a question of guiding students into using all available information toward the understanding of the particular information set at hand. These questions should be addressed within an IVD research environment.

Toward an Understanding of Second Language Acquisition

The emphasis on comprehension has been both the major strength and a weakness of the two models of SLA discussed thus far. Researchers have explored second language comprehension in detail through studies that have described and operationalized the comprehension of second language input under various conditions. Specifically, research has been directed at determining the mechanisms through which input comes to be comprehended, since this process has not been precisely articulated in Monitor Theory. Recently, however, without questioning the necessity of comprehension to acquisition, theorists have begun to doubt its sufficiency. Emphasis on comprehension potentially may result in an unsatisfactory level of grammatical accuracy in learner production. Perhaps more cogently stated, although it is clear that a second language will not be acquired if it is not understood by the learner, there is no evidence to suggest that comprehension is the only process necessary for acquisition to proceed.

A major research question, therefore, still remains: what is the effect of comprehension of input on second language acquisition, where acquisition is defined as the internalization of target language input structures into a developing interlanguage grammar and where such acquisition is measured through demonstrations of productive ability to use those structures in target language interaction. SLA theoretical models now seek to articulate the processes involved in the internalization and mental representation of target language structures and in the learner's eventual ability to use them accurately and appropriately. The IVD research environment offers the advantage of controlling and documenting input to learners and learner actions taken while attempting to comprehend the input, and this provides an ideal environment for investigating second language processes. By combining technological observation with regular assessment of learners' development in the target language, researchers may begin to understand how the structures in the input are manipulated by learners and how grammar and meaning become internalized during comprehension. Studies of language acquisition (rather than studies of

language comprehension) may be undertaken within either or both the Negotiated Interaction Model of SLA or the Cognitive-Processing Model of SLA.

The Cognitive-Processing Model of learning addresses the issue of determining how information is internalized by examining short and long term memory structures (STM and LTM). Memory is thought to be composed of a sensory register where input is held briefly while phonemes are decoded; a short term store, where known linguistic rules and other knowledge systems are employed to decode the semantic message; and a long term store where linguistic rule systems and other knowledge frameworks reside permanently (Atkinson and Shiffrin, 1968, Nagle and Sanders, 1986). Different information-handling techniques are postulated for the perception, comprehension and eventual acquisition of new linguistic systems. According to McLaughlin (1987), an advocate for Cognitive Theory as a basis for second language acquisition research, "the central premises of Cognitive Theory are: (1) learning a complex cognitive skill involves the use of various information-handling techniques to overcome [memory] capacity limitations, (2) through practice, component skills become automatized, and controlled processes are freed for other functions, and (3) there is a constant restructuring of internalized representations as the learner achieves increasing degrees of mastery" (p. 151).

Two modes of information processing are postulated to handle the target language input: automatic processing of information and controlled processing of information. Each mode of processing involves the participation of a different kind of already-processed and stored information (i.e., knowledge that is internalized and stored as nodes). During controlled information processing, "a temporary sequence of [independent] nodes are activated under control of, and through attention by [the learner]" (Schneider and Schiffrin, 1977, p. 156). Once the task demands and attention controls are absent, the nodes return to their disassociated state in memory leaving no permanent effect of the organization in long term memory structures. This contrasts with automatic information processing, during which a particular input configuration stimulates an already-associated sequence of nodes that then becomes active to perform the task. The association of nodes is the result of learning. For cognitive theorists, the controlled vs. automatic processes distinction adequately explains observed differences in language behavior (i.e., ability to perform on a test, but inability to use the same language information in natural conversation).

Linguistic knowledge, once processed, is also considered to be of two types--explicit and implicit--both of which are generally modelled as equal in complexity to, but separated from, other forms of knowledge (Nagle and Sanders, 1986). Explicit knowledge is stored as isolated, unsequenced nodes, only available for temporary sequencing during controlled processing in short term memory. Implicit linguistic knowledge, on the other hand, is a thoroughly associated sequence of nodes which, when called upon for automatic processing, is utilized as a system of information, i.e., as sets of related bits of frameworks--or schemata. This explanation is preferred over Krashen's learning/acquisition distinction which postulates that knowledge is internalized in two different ways and that, once internalized, the knowledge is permanently stored in a manner that reflects the way in which it entered. The cognitive-processing model offers an explanation of differing information-handling techniques for the internalization of input, but also recognizes an interaction between stored information--an interaction that is triggered by the type of information handling techniques employed. In other words, information stored in one form may be altered by subsequent handling of the same information by a different set of techniques.

Bialystok (1981) has suggested that language knowledge is internalized either functionally or formally and that the nature of the input-oriented information-handling technique determines how the language knowledge will be represented in the interlanguage grammar. Formal information handling leads to explicit knowledge representation (known as "conscious knowledge"), and functional information handling leads to implicit knowledge representation (known as "intuitive knowledge"). Once internalized, however, the nature of the mental representation may be changed through the influence of the language knowledge retrieval information-handling techniques. McLaughlin (1987) has postulated that language skills are often first learned through formal input handling; then through practice and routinization, language knowledge becomes available for production through automatized retrieval processes. Learning a language, as noted above, is considered to be analogous to the acquisition of any complex skill. Therefore, second language acquisition requires the automatization of all the component subskills of the overall ability to understand and use language.

Many researchers have noted that learning requires more than gaining automaticity. Integral to learning is the process by which organizational structures (e.g., schemata) are constantly modified in accordance with and for the purpose of integrating new information (Rumelhart and Norman, 1978, Karmiloff-Smith, 1986). The final phase of learning a complex cognitive skill is the restructuring phase in which all related information that has already been acquired is reorganized in storage in light of the newly internalized input (Cheng, 1985). Though practice results in the integration of subskills into automatized routines, "the learner [also] needs to impose organization and to structure the information that has been acquired" (McLaughlin, 1987, p. 136). The result of this process is a restructuring of the components of the complex skill into a new and more efficient procedure for handling the task at hand (Cheng, 1985). A fruitful area of IVD research would be the determination of activities or learner actions which would result in automatized access to linguistics knowledge, controlled access to linguistic knowledge, and restructured information/knowledge/or language frameworks. While cognitive models have articulated the details of this process, researchers are still faced with the challenge of articulating unobservable phenomena into operationalized behaviors which may be documented in IVD language learning experiments.

Negotiated interaction research has already moved beyond the description of the features of negotiation which facilitate comprehension to the more difficult question of how negotiation and comprehension facilitate second language acquisition. Swain (1985) has claimed that comprehensible input is not sufficient to promote second language acquisition; learners must also engage in comprehensible output in order for the morphosyntax of the interlanguage to develop sufficiently to reflect a level of mastery of the target language. Comprehensible output is defined by Swain as a process of grammatical organization of learner productions during negotiated interaction. Working within the Negotiated Interactional Model of SLA, Pica and her students have begun to identify and describe what Swain has labelled 'comprehensible output.' In this line of research, learners are "pushed" to produce comprehensible output when given signals by their interlocutors that the initial attempt to communicate was not clear. Thus, learners must modify and restructure their initial utterances until they can be understood. In a successful resolution of negotiation the NNS can respond to NS signals by modification of the initial trigger phonologically, semantically, morphologically, or syntactically, thus producing comprehensible output" (Pica, Holliday, Lewis and Morganthaler, 1989). In other words, through being forced to produce comprehensible output, learners generate more target-like grammatical structures.

An important finding of this research was that across several tasks which varied according to type of information exchange involved, the kind of NS signals of lack of comprehension of the initial NNS utterance had a significant effect on the negotiation. NNS modification of an initial utterance occurred most often when NSs signaled "an explicit need for clarification rather than [when NNSs] provided a model for confirmation" (Pica et al, 1989, p. 83). These findings provide empirical confirmation for the warning noted above against utilizing the IVD environment for modelling and repetition exercises (i.e., "drill and kill"). Rather, the learner must be encouraged to strive to comprehend difficult target language input using a variety of resources provided in the IVD context (such resources may be designed and coded to resemble the features of negotiated interaction found in NS-NNS discourse), and eventually, the learner must be encouraged to produce complex, but comprehensible, target language structures.

Three major features of negotiated interaction, which have been identified in previous studies, are requesting clarification, confirming understanding, and checking for comprehension. In the event of a breakdown in communication, any of these modifications in the interaction may be employed by either speaker to repair the conversational flow. In the IVD environment (at the present state of the technology), it may be hypothesized that clarification and confirmation are best allocated to learner control, and that comprehension checking falls neatly into the domain of computer control. In a study to be conducted at the US Air Force Academy, a variety of instantiations of clarification, confirmation and comprehension checking, coded into the IVD software are hypothesized to facilitate both comprehension and acquisition. The language development of undergraduate French students will be compared under three conditions: (1) input only (learners view a video without any computer intervention); (2) input and interaction (learners view the same video, but may request confirmation and clarification at any time and are assessed for level of comprehension at regular intervals); and (3) control (learners do not view the video, but participate in the same regular language class instruction as the rest of the subjects). The input in the study will be provided by the video portion of the *French in Action* series (Capretz, 1987). The particular interactional features available to input plus interaction subjects will be in each of two categories--user-

requested and software-directed. User-directed interactional functions include (1) exact repetition, where the learner can stop the video at any point and repeat the previous utterance; (2) semantic repetition, where the learner can identify a lexical item and request a paraphrase or synonym of the item in the target language; (3) clarification of content. The computer-directed function will be comprehension checking. As the subjects view the video, they will be asked comprehension questions at regular intervals, and subjects will not be permitted to move to the next segment of the video until they reach the criterion level of understanding.

In addition to documenting the input and the learners' interactions with the input as they strive to comprehend the *French in Action* video, the experiment will include regular assessment of subjects' development in French. Periodically, subjects will be asked to narrate (in French) portions of the video which they have already seen. This measure will tap subjects' productive ability in the L2. Subjects will also be given more guided evaluations of their interlanguage ability so that the development of particular areas of grammar may be tracked throughout the experimental treatment. It is hoped that this combination of comprehension monitoring and second language development assessment will shed light on the relationship between the two.

Conclusion

The research reviewed and proposed in this chapter suggests many promising areas for cooperation among IVD software developers and SLA researchers. From the interactive perspective on second language acquisition, both learner-internal mechanisms and environmental factors contribute to language development. While much research has documented the nature of the input available to L2 learners, little is known about how learners internalize the input into their developing interlanguage grammars. Since the internalization of input is the heart of the language acquisition process, how learners interact with input must become the focus of SLA research. IVD research programs may contribute to this effort by providing rich sources of input and interaction data captured through learner and session logs. Such data is likely to contribute substantially to the theory building--research--theory refinement cycle that will eventually lead to a more complete understanding of the process of second language acquisition.

References

- Atkinson, R. & Shiffrin, R. (1968). Human memory: A proposed system and its control processes, In Spence, K. & Spence, J. (Eds.), *The Psychology of Learning and Motivation*, Vol. 2. New York: Academic Press.
- Ausubel, D. (1968). *Educational Psychology: A Cognitive View*. New York: Holt, Rinehart & Winston.
- Bialystok, E. (1981). The role of linguistic knowledge in second language use. *Studies in Second Language Acquisition* 4(1), 31-45.
- Bransford, J. (1979). *Human Cognition: Learning, Understanding and Remembering*. Belmont, CA: Wadsworth Publishing Co.
- Bransford, J. (1983). Schema activation--schema acquisition. In Anderson, R., Osborn, J. & Tiernay, R. (Eds.), *Learning to Read in American Schools*. Hillsdale, NJ: Lawrence Erlbaum.
- Bransford, J., Sherwood, R., Kinzer, C. & Hasselbring, T. (1989). Havens for learning: Toward a framework for developing effective uses of technology. ERIC document ED262752.
- Capretz, P. (1987). *French in Action Videodisc Series*. New Haven: Yale University.
- Carrell, P. (1988). Some causes of text-boundedness and schema interference in ESL reading. In Carrell, P., Devine, J. & Eskey, D. (Eds.), *Interactive Approaches to Second Language Reading*. Cambridge: Cambridge University Press.
- Chaudron, C. (1983). Simplification of input: Topic reinstatements and their effects on L2 learners' recognition and recall. *TESOL Quarterly* 17(3), 437-58.

- Chaudron, C. (1988). *Second Language Classrooms: Research on Teaching and Learning*. New York: Cambridge University Press.
- Cheng, P. (1985). Restructuring vs. automaticity: Alternative accounts of skill acquisition. *Psychological Review*, 92, 214-23.
- Chomsky, N. (1957). *Syntactic Structures*. Mouton: The Hague.
- Chomsky, N. (1965). *Aspects of the Theory of Syntax*. MA: MIT Press.
- Chomsky, N. (1981). Principles and parameters in syntactic theory. In Hornstein, N. & Lightfoot, D. (Eds.), *Explanations in Linguistics*. London: Longman.
- Curtiss, S. (1977). *Genie: A Linguistic Study of a Modern Day "Wild Child."* New York: Academic Press.
- Doughty, C. & T. Pica (1986). Information-gap tasks: Do they facilitate second language acquisition? *TESOL Quarterly* 20(2), 305-25.
- Ellis, R. (1986). *Understanding Second Language Acquisition*. Oxford: Oxford University Press.
- Goldin-Meadow, S. (1982). The resilience of recursion: A study of a communication system developed without a conventional language model. In Wanner, E. & Gleitman, L. (Eds.), *Language Acquisition: State of the Art*. New York: Cambridge University Press.
- Hatch, E. (1978a). *Second Language Acquisition*. Rowley, MA: Newbury House Publishers.
- Hatch, E. (1978b). Acquisition of syntax in a second language. In Richards, J. (Ed.), *Understanding Foreign and Second Language Learning*. Rowley, MA: Newbury House Publishers.
- Johnson, S. & Newport, E.. (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology* 21, 60-99.
- Karmiloff-Smith, A. (1986). Stage/structure vs. phase/process in modelling linguistic and cognitive development. In Levin, I. (Ed.), *Stage and Structure: Re-opening the Debate*. Norwood, NJ: Ablex.
- Krashen, S. (1977). Some issues related to the monitor model. In Brown, H.D., Yorio, C. & Crymes, R. (Eds.), *On TESOL '77: Teaching and Learning English as a Second Language: Trends in Research and Practice*.
- Krashen, S. (1980). The input hypothesis. In *Georgetown University Roundtable on Language and Linguistics 1980*. Washington, D.C.: Georgetown University Press.
- Krashen, S. (1982). *Principles and Practices of Second Language Acquisition*. Oxford: Pergamon Press.
- Long, M. (1980). *Input, Interaction and SLA*. Unpublished doctoral dissertation. UCLA, Los Angeles.
- Long, M. (1985). Input and second language acquisition theory. In Gass, S. & Madden, C. (Eds.), *Input in Second Language Acquisition*. Rowley, MA: Newbury House Publishers.
- Long, M. (1990, March). *The least a second language acquisition theory needs to explain*. Paper presented at the 24th annual TESOL Convention. San Francisco, CA.
- McLaughlin, B. (1987). *Theories of Second Language Learning*. London: Edward Arnold.
- Mohan, B. (1987, August). *Language use around the computer*. Paper presented at the 8th World Congress of Applied Linguistics, Sydney, Australia.
- Nagle, S. & Sanders, S. (1986). Comprehension theory and second language pedagogy. *TESOL Quarterly* 20(1), 9-26.
- Pica, T. (1987). *Classroom interaction, negotiation and comprehension: Redefining relationships*. Paper presented at the 21st annual TESOL Convention. Miami, FL.

- Pica, T. & Doughty, C. (1985). Input and interaction in the communicative classroom: A comparison of teacher-fronted and group activities. In Gass, S. & Madden, C. (Eds.), *Input and Second Language Acquisition*. New York: Newbury House Division of Harper & Row Publishers.
- Pica, T., Doughty, C. & Young, R. (1986). Making input comprehensible: Do interactional modifications help? *ITL Review of Applied Linguistics* 72, 1-25.
- Pica, T., Holliday, L., Lewis, N. & Morgenthaler, L. (1989). Comprehensible output as an outcome of linguistic demands on the learner. *Studies in Second Language Acquisition* 11(1), 63-90.
- Pica, T., Young, R. & Doughty, C. (1987). The impact of interaction on comprehension. *TESOL Quarterly* 21, 4, 737-58.
- Rumelhart, D. (1977). Toward an interactive model of reading. In Dornic, S. (Ed.), *Attention and Performance*. Hillsdale, NJ: Erlbaum.
- Rumelhart, D. & Norman, D. (1978). Accretion, tuning, and restructuring: Three modes of learning. In Cotton, J. and Klatzky, R. (Eds), *Semantic Factors in Cognition*. Hillsdale, NJ: Lawrence Erlbaum.
- Sachs, J. & Johnson, M. (1981). Language learning with restricted input: Case studies of two hearing children of deaf parents. *Applied Psycholinguistics* 2, 33-54.
- Schneider, W. & Schiffman, R. (1977). Controlled and automatic processing. I: Detection, search and attention. *Psychological Review* 84, 1-64.
- Spolsky, B. (1989). *Conditions for Second Language Learning*. Oxford: Oxford University Press.
- Swain, M. (1985). Communicative competence: Some roles of comprehensible input and comprehensible output in its development. In Gass, S. & Madden, C. (Eds.), *Input in Second Language Acquisition*. Rowley, MA: Newbury House Publishers.

From Theory to Practice: A Model for an Interactive Videodisc Lesson

Duane E. Bright

Miguel Verano

Ruben A. Cubero

United States Air Force Academy;

Introduction

Carroll (1986) observes that "What makes L2 learning different from the learning of most other subject matters is that a special type of correspondence between language input and meaning must be acquired" (p. 105). When one considers the many dimensions of what it means to "learn a foreign language," language learning is not only different from learning other subject matters, but it becomes clear that we are dealing with a phenomenon of far greater complexity. This latter observation is supported by the roller-coaster nature of the changing concepts of what language is and, consequently, by what it means to teach a foreign language. The purpose of this article is not to add another method to the plethora of already existing methods out there, i.e., we are not proposing the new interactive videodisc (IVD) method for teaching second languages. We do not wish to create a method of instruction that is defined by a particular medium that can be used for delivering a segment of instruction. Rather, this article is motivated by the desire to demonstrate how the capabilities inherent in IVD technology can effectively satisfy various hypothesized conditions required for language acquisition as indicated by current second language acquisition (SLA) theory.

Background

In the Department of Foreign Languages at the United States Air Force Academy (USFA) we have designed an interactive videodisc language learning center with 32 stations for integration into our seven language curriculum. Each station contains a Sony Advanced View 3020 system that includes an IBM PC/AT class microcomputer, an LDP 2000 videodisc player, a PVM 1271Q monitor, keyboard and mouse all operating under Microsoft Windows. The capabilities of this hardware have allowed us to investigate many of the variables hypothesized to influence how we learn foreign languages and, consequently, how best to integrate interactive videodisc technology into the learning process. Pederson (1987), in a discussion of research on computer-assisted language learning (CALL), provides an important observation regarding how to approach the use of technology. Pederson states that "CALL, in and of itself, does not result in more and better learning; rather it is the specific way instruction is coded in CALL software that has the potential of affecting learning positively, for learners in specific contexts (p. 107)." A logical corollary of Pederson's observation would be that the way we code instruction, therefore, should be informed by what is known about the process of second language acquisition. Attending to this corollary may also help us heed Weible's (1987) caveat to avoid "treating the computer as a substitute vehicle for existing instructional techniques and methodologies." This latter "plea" for creativity is, indeed, timely and appropriate. We would suggest, however, that by using what we know about the processes of second language acquisition as the fundamental organizing principle for coding instruction, we can avoid falling into the "throwing the baby out with the bath water" syndrome so characteristic of our profession.

Theoretical Underpinning

Focusing on the particular problems of language beginners, we have incorporated into our instruction many ideas that require investigation, and, wherever possible, ideas supported by research. Several models of second language acquisition indicate a potentially powerful role for interactive videodisc. One can extrapolate from Krashen's (1982) input hypothesis--which simply states that we acquire (not learn) language by understanding

input that is a little beyond our current level of (acquired) competence--an extremely important role for IVD as a medium for providing language input.

Other models of second language acquisition (Bialystok, 1978; McLaughlin, 1983; Chaudron, 1985; and Long, 1985), albeit not in agreement regarding the nature of the interaction between various hypothesized forms of knowledge representations, suggest a vital function for input in the language acquisition process. Clearly, as pointed out by Chaudron (1985), Oller (1983), and Krashen (1982), input, while necessary, is not sufficient for acquisition to take place. Input must become intake, i.e., it must be comprehended. A weaker position regarding the relationship between intake and acquisition may not attribute such a powerful role to comprehensible input as does Krashen. Despite the polemics of this issue, one cannot deny that listening comprehension, in and of itself, is a necessary skill in which to attain proficiency when learning a foreign language. Improving comprehension, then, has become a major objective for all our basic level language students. Our contention is that IVD is a medium that is particularly well suited for developing these comprehension skills.

Another controversial issue resides in the area of how different language knowledge stores are brought to bear on the language comprehension process. Does the brain represent (store) knowledge according to the nature, e.g., conscious or unconscious, of the process by which information is perceived? If the answer is "yes"--the answer may indeed be "no"--can language learners, while attending to meaning, draw on qualitatively different language stores (learning vs. acquisition, implicit vs. explicit, analyzed vs. unanalyzed chunks of input, etc.) as they are trying to comprehend? Can a "psycholinguistic processing grammar" (Garrett, 1987) sensitize language learners to linguistic features in input thereby increasing the comprehensibility of input and short-cutting the overall acquisition process? From the standpoint of psycholinguistic processing, do we use a less specific, more undifferentiated knowledge of grammar, as suggested by Rivers (1986), when we comprehend messages than when we produce messages? These are important empirical questions that deserve further research. Discussing the complex task of explaining the comprehension process, Slobin (1979) writes:

The listener...is constantly trying to build an internal representation for the sentences he receives, relying on all available information: grammatical structure, meaning, knowledge of the world, knowledge of the speaker, knowledge of conversational rules, and so forth. No one of these aspects of structured knowledge is sufficient to account for the processes of comprehension (p. 53).

Accordingly, comprehension seems to be a process that integrates many different types of information in a manner that is, at best, poorly understood. Furthermore, the influence of comprehension on language acquisition is likewise poorly understood. Considering the above discussion of various theoretical issues regarding the nature of comprehension and its role in SLA, we have made three assumptions vis-a-vis the implementation of interactive videodisc technology:

1. Comprehension of language input is critical to the process of language acquisition;
2. Comprehension can be facilitated by providing any of the knowledge types mentioned above by Slobin; and
3. Negotiation of meaning via output processes (production) promotes second language acquisition.

A fourth assumption deals with the nature of the video material used in the development of IVD lessons. Our experience indicates that from a motivational standpoint video segments that have an episodic quality capture and maintain student interest better than segments lacking any episodic coherence. This insight seems to be in consonance with Oller's (1983) episode hypothesis which states that "text (in the sense of any stretch of discourse) will be easier to produce, to understand, to recall, and in general to profit from if it is episodically organized (p. 3)." Oller makes the following six recommendations to teachers regarding how to apply the episode hypothesis to the selection and use of materials that are of equal value in the selection and employment of video materials:

1. Use motivated text with significant conflicts in pursuit of meaningful goals;
2. Seek out stageable action;
3. Respect the logic of experience;
4. First establish the facts;

5. Break the text down into manageable chunks; and
6. Make multiple passes through the text, deepening comprehension on each pass (p. 3).

These assumptions undergirded the development of our template (a template is a preplanned series of options, i.e., aids, activities, mastery checks, etc., that are coded in the software with the purpose of facilitating and assessing the learning process) for providing IVD materials to our students at USAFA. We designed the template's follow-on in-class activities in order to furnish students with opportunities to "negotiate meaning" based on the language exposure in the language learning center. We must again emphasize the following caveat regarding the use of this model for IVD instruction. Many of the above assumptions contain components that must be submitted to rigorous testing before they can be regarded as dogma for the design of IVD materials. To this end we are planning an ambitious research agenda that takes advantage of the tremendous potential our IVD language learning center has as a "test bed" for this needed research. In addition to the research objective, however, there is also the pedagogical need to provide motivating learning materials to our students. Alas, that is a dilemma in which we as teachers often find ourselves. Before we arrive at the answers to our many research questions, we must do the best job possible in the classroom. Our hope is that this model is one step closer to helping us meet both important objectives.

Instructional Design Considerations

After attending to the above-mentioned theoretical considerations, we recognized a need to adhere to an organizing principle or set of principles for the lesson designs. Gagné (1979) states that "instruction is a set of events external to the learner which are designed to support the internal processes of learning (p. 156)." Clearly, learning is an internally triggered process, i.e., a process that is controlled by and takes place within the learner. It is interesting to note that instruction can occur without any learning occurring and, vice versa, there can be learning without any formal instruction. There are, nevertheless, external events that can influence the idiosyncratic, internal process of learning. There are few educators who feel they cannot arrange instructional events in such a way as to have an impact on the learning of their students. An effective model for instruction, therefore, should incorporate the following events posited by Gagné (1979):

1. Gain attention,
2. Inform the learner of the objective,
3. Stimulate recall of prerequisite learnings,
4. Present the stimulus material,
5. Provide learning guidance,
6. Elicit performance,
7. Provide feedback about performance correctness,
8. Assess the performance, and
9. Enhance retention and transfer.

Merrill, Li, and Jones (1989), in explicating their second generation instructional design (ID₂) theory--Gagné's instructional design theory is regarded as first generation instructional design (ID₁)--provide for a design consideration that may be essential to the planning of instruction when second language acquisition is the desired outcome. ID₂ allows for the design of integrated sets of knowledge and skills. Of importance, also, is their concept of an instructional transaction, which is broadly defined as "a particular interaction with a student (p. 15)." Although Merrill et al. describe a system for instructional design of considerable complexity, these two fundamental ideas were selected as guiding principles as we developed our IVD template for foreign language instruction. Why do we regard these two ideas as important to developing a template for second language instruction?

Merrill, et al., with their recognition that some bodies of knowledge and certain skills must be addressed as integrated wholes rather than as an accumulation of discrete parts, provide for the insight that language is eminently integrative in nature. This concept of language should be clear in the way we present the content of our

language courses to our students. IVD can be coded so that language is broken down into its many components and presented not in a holistic, integrative fashion but rather as a series of discrete parts in a building-block fashion. Our view, however, is that this strategy is inappropriate. Students should operate on "whole" language that is targeted for their acquisitional needs. One of the greatest strengths of IVD as a medium for delivering instruction is the capacity for presenting whole, authentic language embedded in appropriate contexts.

The obvious fact that face-to-face communication is inherently interactive must also be addressed during the design process. Merrill, et al. provide for this observation via their concept of transactional interactions. IVD can be coded in such a way that learners interact actively with the language that is presented to them. To the extent that conversational management strategies are included in the design of the software students can resort to them as they would in face-to-face communication. IVD can also be coded to require students to make decisions that influence how a particular scenario will evolve. However, owing to the complexity, difficulty, and cost of creating these types of open-ended interactions (this branching capability adds a non-linear dimension that must be attended to during the production of the video materials) at this time we selected to use already existing video material and to provide students with conversational management tools hypothesized to aid their comprehension of the video programs. Students can have a segment repeated as often as needed, they can have text overlaid on the video, they can highlight individual words in that text and be given a definition and/or other pertinent information, and, in the very near future, students can repeat an audio segment at a slower speed without any distortion of the sound.

Well designed instruction requires attention to Gagné's nine instructional events and to the insights incorporated into ID₂ by Merrill, et al. regardless of the means for the delivery of that instruction. In this respect, IVD lessons are certainly no different. Indeed, since it is difficult to adjust spontaneously already coded instructional events to meet the needs of a particular learning situation, considerably more reflection must go into the coding of instruction when "mechanical" delivery systems are used. In other words, one must anticipate the many needs that a broad spectrum of learners will potentially have so that instruction can be encoded into the software to meet these needs.

Planning the Lesson

In looking for appropriate videodisc materials for the beginning Spanish level we selected two series produced by the Linguex Company and the British Broadcasting Company. The former's videodisc product is entitled *Linguex* and the latter's is entitled *Zarabanda*. The main advantages of the *Linguex* program are that the entire production is only one hour in duration, the actors are young, attractive and accomplished, the plot is interesting, current and easily followed, and the disc contains two audio tracks. *Zarabanda*'s strengths are the coherence of its episodes and the many cultural insights contained in these episodes.

The first step to the developmental process was to subdivide these videos into individual segments, some approximately 2-4 minutes long but no segment longer than twenty minutes. These segments serve as the basis for at least a twenty-five minute lesson in our language syllabus. We then added a number of features to each segment designed to focus attention, assist in comprehension, determine mastery (Gagné), and provide a linkage to classroom activities. We addressed the many considerations listed above during the following four phase development process.

Phase #1--The Overview: This phase encompasses the following instructional events of the design process:

1. Learners' attention is focused on the task at hand;
2. Learners are informed of the lesson objective in English for beginning students and in the target language for more advanced students;
3. Learners are provided requisite prior knowledge of a contextual nature to prepare them for the specific task at hand; and
4. Learners should be sufficiently motivated (based on the selection of video shots) to want to continue the lesson.

To introduce a video segment we display an initial menu that progressively shows the following items in succession as the student selects each one, beginning with:

OBJECTIVE

When the student selects the OBJECTIVE option, the objective for that lesson is displayed in English or in the target language. The language to be displayed is determined at the onset of the lesson when the student initializes the program and informs the computer of his or her language level. Once the student has read the objective, the "Continue" button will display the following:

OBJECTIVE

PREVIEW

At this point, the student has the option of returning to the OBJECTIVE or selecting the PREVIEW option. In the PREVIEW option, representative still frames and short video bursts with subtitles in English are shown to provide a general overview of what the student will see in the overall lesson segment. This portion of the program is very similar to commercial movie previews designed to entice the audience to see the movie.

Underwood (1989) has developed a very effective technique that allows students to very quickly preview key scenes and the accompanying dialogue. Underwood displays a "story map," which is basically a spatial representation of the sequence of scenes in each episode, in this case, the Spanish BBC series, *Zarabanda*. The two-dimensional drawings or icons on the map help students "visualize the flow of the scenes, to see time in terms of space. (p. 9)" By clicking on the icons successively, the student not only sees a short representative video burst of the scene, but quickly gets a general notion of the thrust of the episode. Underwood further adds that by having the ability to preview the story the student will be able to make predictions about future events in the story. Predictions such as these are a kind of "pre-reading" or "pre-viewing" which helps the student better understand the material.

Once the student is finished with the PREVIEW option, the "Continue" button will display the following screen:

OBJECTIVE

PREVIEW

CUES

Again, the student is able to select any of the previous options at any point. Selecting CUES provides the student with cues to comprehension only in those portions of the upcoming video segment where the content is of sufficient complexity that additional information is required to facilitate comprehension. The format followed is to play a short video burst that contains the syntactic or lexical items that need possible clarification, and at the end of the video burst, to display an overlay screen with the words and expressions that are key to understanding. The control functions available for the student are: "play" to listen to the pronunciation of each item displayed, "glossary" to present a parallel meaning in the target language which also might include graphics and/or video, "back" to repeat the previous portion of the segment, if needed, and "continue" to go on with the program. The student always has the capability to exit the program and return to the initial menu by clicking on the "Exit" button. This phase attends to stimulating recall of requisite prior knowledge and to providing the material to be comprehended along with the aids to facilitate comprehension. If students are satisfied with the comprehension results achieved, they will continue to the next phase of the program.

Phase #2--Viewing The Video: In this phase, students watch the video from start to finish. During this phase, however, they can stop the video at any point by pressing the spacebar on the keyboard or clicking the mouse. Once the student stops the video, a series of options appear at the bottom of the screen as follows:

AUDIO	PLAY	TEXT	REPEAT	BACK	CONTINUE
-------	------	------	--------	------	----------

The student can select the AUDIO button to hear either audio track 1 or audio track 2 (if the videodisc has the second audio track recorded on it). The first audio track normally carries the normal script, whereas the second audio track may contain a third person narrative of what has transpired in the video segment. The PLAY button allows the student to see the short segment of video (a complete logical utterance) seen immediately prior to stopping the video. If the play button is pressed again the program will proceed to the next complete utterance in the video. TEXT allows the student to display the text of the video segment being watched. The student can select any word in the text displayed on the screen and obtain a definition for that word. The TEXT button is tied to the audio track selected. If the student has selected audio track 1, then the text for that track will be displayed. By the same token, if the student has selected audio track 2, then the text corresponding to audio track 2 will be displayed on the screen. As the software becomes more sophisticated we envision that another control function--HELP, will be added to allow the student access to reference documents that can aid in formulating correct responses. These reference documents will most likely be contained in compact discs and will include dictionaries, thesauri, grammar handbooks, and the like. The REPEAT button allows the student to repeat the video segment (a segment of video containing a complete utterance). The REPEAT button does exactly what it implies, that is, it repeats an utterance over and over as many times as the student wishes. Plans exist for the inclusion of another button--SLOW, whereby a student can slow down the speed of an utterance for greater understanding. Slower speech will become possible with the installation of hardware that will digitize speech. The BACK button takes the student back an utterance each time that it is selected. The CONTINUE button allows the student to continue viewing the video without interruption.

Phase #3--Mastery Check: Once the student has completed the "Viewing the Video" phase, we use a mastery check to determine the students' depth of understanding and to branch them into one of two tracks based on their performance. Multiple choice, true/false questions and cloze tests are presented to the student after the student feels ready to proceed to this phase. If students do not achieve a minimum score of 80%, they return to Phase #2 for further viewing. If students achieve a minimum score of 80% or above, they proceed to Phase #4.

Phase #4--Linkage To Classroom: One of the useful features of the Linguex videodisc is the availability of two audio tracks--one that contains the main dialogues of the actors, and the other that contains a narrative explaining in the third person what the student is viewing. This track is better suited for classroom activities as it easily lends itself to speaking exercises about the content of the video. The students will have had the opportunity to select audio track 2 during phase # 2, "Viewing the Video."

In the classroom, the instructor can proceed with a number of established question-and-answer techniques in order to ascertain that the students are thoroughly familiar with the characters involved in the segment and with the general story line. The instructor should emphasize and repeat frequently those idiomatic and grammatical expressions that are relevant to the students' progress in the syllabus. During this phase, oral production is limited to short answers. The linkage questions generally deal with the actions of two or more of the principal characters in the video segment, and require the students to transform themselves mentally into the various roles in the video. Questions are asked that are designed to synthesize their own knowledge of the situations encountered with what was viewed in the segment. In order to attain a higher level of oral production, the instructor develops a short general scenario associated with a cluster of linkage questions and asks the students what their oral response(s) would be. This phase requires more flexibility and spontaneity on the part of the instructor in order to anticipate student responses and request follow-up information based on the answers given by the students.

The final phase to the classroom activities allows practice and evaluation time in small groups during which students role-play situation(s) displayed in the video segment. The students are divided into small groups to accommodate all the principal actors in the segment. The instructor then provides the evaluation criteria such as comprehensibility, creativity, sociolinguistic and syntactic appropriateness, etc. Students then must develop and practice scenarios based on the viewed video segments. Student's oral skills will be qualitatively better because of the more effective use of preparation time for transforming what was viewed on the video to personal communications on the part of the student.

Summary

The instructional design process is a time intensive labor regardless of the intended delivery system. Initially, at least, this inherent problem is compounded when you use a mechanical delivery system such as IVD. At USAFA we have attempted to resolve this problem by developing generic templates that we can use across all the languages taught in our curriculum. Due to the time intensive nature of developing these templates, it is necessary that they accommodate two purposes: instruction and research. Apart from describing this model, we furnished the fundamental theoretical underpinnings of this particular model. Establishing a sound theory base also has a dual purpose. First, the theory provides a foundation into which we can tie as we make our decisions regarding what must be done to provide effective instruction. Second, a sound theoretical base allows us to derive hypotheses that can be tested within the model thus aiding us to organize our research endeavors. In an academic setting where students are the number one priority and research a secondary consideration, the template concept may offer the only reasonable solution to both needs considering the amount of time and expertise required when designing instruction that employs IVD.

References

- Bialystok, E. (1978). A theoretical model of second language learning. *Language Learning*, 28, (1), 69-83.
- Carroll, J. B. (1986). Second language. *Cognition and Instruction*. (pp 83-125) Academic Press, Inc.
- Chaudron, C. (1985). On models and methods for discovering learner's processing of input. *Studies in Second Language Acquisition* 7, (1), 1-14.
- Gagné, R. M., & Briggs, L. M. (1979). *Principles of Instructional Design*. New York: Holt, Rinehart and Winston.
- Garrett, N. (1987). A psycholinguistic perspective on grammar and CALL. In W.F. Smith (Ed.) *The ACTFL Foreign Language Series, Modern Media in Foreign Language Education: Theory And Implementation*, (pp 169-196), Lincolnwood, IL: National Textbook Company.
- Krashen, S. D. (1982). *Principles of Practice in Second Language Acquisition*. New York: Pergamon Press.
- Long, M. H. (1985). A role for instruction in second language acquisition. In K. Hyltenstam and M. Pienemann (Eds.) *Modeling and Assessing Second Language Acquisition* (pp 77-99). Clevedon, Avon, England: Multilingual Matters.
- McLaughlin, B., Rossman, B. T. & McLeod, B. (1983). Second language learning: an information processing perspective. *Language Learning* 33, (2), 135-58.
- Merrill, M. D., Li, Z., & Jones, M. K. (1989). Second generation instructional design. Paper submitted to Educational Technology.
- Oller, J. W. Jr. (1983). Some working ideas for language teaching. In J.W. Oller & P. A. Richard-Amato (Eds.) *Methods That Work: A Smorgasbord of Ideas for Language Teachers*. Rowley, MA: Newbury House Publishers.
- Pederson, K. M. (1987). Research on CALL. In W.F. Smith (Ed.) *The ACTFL Foreign Language Education Series, Modern Media in Foreign Language Education: Theory and Implementation*, (pp 99-131), Lincolnwood, IL: National Textbook Company.
- Rivers, W. M. (1986). Comprehension and production in interactive language teaching. *The Modern Language Journal*, 70, (1), 1-7.
- Slobin, D. I. (1979). *Psycholinguistics*. Glenview IL: Scott, Foresman and Company.
- Underwood, J. (1989). Hypermedia and language learning. *CALICO Journal* 6.3:7-20.
- Weible, D. M. (1987). Towards a media-specific methodology for CALL. In W.F. Smith (Ed.) *The ACTFL Foreign Language Education Series, Modern Media in Foreign Language Education: Theory and Implementation*, (pp 67-83), Lincolnwood, IL: National Textbook Company.

How to Get Started in Interactive Videodisc: A User's Perspective

Alice Slaton
Ventura College

The purpose of this article is to introduce the field of Interactive Videodisc (IVD) to language educators. It attempts to give a practical overview by first defining what IVD is, how it works, why it is useful, and why it is an important technology for language teachers and learners. In the second part of this article the author relates her own experience, followed by a discussion and listing of useful resources.

What is Interactive Videodisc? Why look at it for language teaching and learning?

Interactive Videodisc is a powerful medium of communication. The medium used to communicate is an optical disc called a laser videodisc of the LaserVision format. Each side of a 12-inch disc can store 54,000 still frames such as slides or 30 minutes of full motion video. When the disc is placed in a laserdisc player, the user can control the information on the disc, be it still image, video motion, sound or text, with accuracy and speed. Just imagine how useful and efficient this medium can be for teaching and learning: you, the educator, the user, can have instantaneous control of any image, any video sequence, any utterance, any text that is on the disc; you just have to enter the frame numbers.

Video is pervasive in our society. Commercial television is an integral part of our daily lives. Like the jugglers of the Middle-Ages coming to the castle, we now receive our own personal form of entertainment in our living rooms. (Saint-Leon, 1989). Now, interactive videodisc offers us the opportunity to manipulate and efficiently control a chosen audiovisual content.

IVD can offer elegance, ease of use, and substance. When interfaced with a computer, IVD offers a powerful and flexible environment. Jim Griffith (1988), President of Media Learning Systems, defines Interactive Videodisc as a non-linear medium, where the duration of the experience is determined by the user; the content may "follow complex pathways through multiple matrices of branching and termination points, where each pathway carries its own evolving and interrelated audiovisual, computer, instructional, testing, informational, presentation, esthetic component [sig], which combine to meet an established stated objective" (p. 3). The term interactive has come to describe the dialogue between the user/learner and the system courseware. The user controls the pace of his/her learning by controlling the rate of the screen output. Interactive programs are designed to respond to a number of factors distinguishing one learner from another such as interest, performance, pace and ability. The courseware poses questions, analyzes and stores answers and presents feedback within the framework of branching, non-linear instructions.

Levels of Interactivity

The following levels of interactivity have been defined by the Nebraska Videodisc Design/Production Group and are generally accepted and recognized within the videodisc industry:

Level 0: A consumer-model videodisc player with little processing power, capable of linear play of a videodisc without interruption. Examples of level zero videodiscs are most of the extended play discs or CLV discs (please refer to Glossary for the explanation of CLV and CAV formats) of commercial movies. Today there are disc players, such as the Pioneer LD-V8000, that will freeze frame on a CLV disc which means that there can be thousands of discs commercially available that could be useful for language teaching and learning.

Level 1: A consumer-model videodisc player with still/freeze frame, picture stop, chapter and frame addressable, dual-channel audio, no programmable memory, and little processing power. All functions are initiated by manual

inputs from the player's keypad. Picture stop and chapter stop are read from the videodisc. These codes are put on the disc during videodisc mastering process.

Level 2: An industrial-model videodisc player with limited on-board programmable memory. On-board memory is programmed from "digital dumps" contained in audio channel two of a level two encoded videodisc or is programmed manually from the remote controller for answers and branching.

Level 3: Any videodisc player interfaced to an external computer. The player is essentially a computer peripheral with its functions under the control of the computer. New dimensions to linear video are made possible due to the presence of computer intelligence and optical disc accessibility.

Level 4: A videodisc/computer system in which the videodisc is used to store computer-readable digital data as well as analog video and sound information. The videodisc player functions as an optical storage drive to the computer as well as the source of analog picture and sound. Ron Nugent, Director of the Nebraska Videodisc Group (see Appendix) explains, in the Summer '88 Newsletter: "In a Level Four computer Disc Operating System, programming for all computer functions and graphics can be read from the videodisc. Digital data is stored on the videodisc as standard frames of video information. This requires a digital-to-analog encoder. Digital data thus encoded as analog video can be fed to a standard videodisc mastering machine. The data occupies video frame space on the disc, reducing the amount of standard video and audio available. The density of storage is so great, however, that 100 megabytes of digital data in a typical encoding scheme would take less than five minutes from the available video program time" (p. 3).

Why should a language educator look at interactive videodisc?

Why is it important for language teaching and learning?

What are the benefits?¹

Technology with its rapid advances and changes has helped shape the modern world. With today's global economy; what happens in China affects what happens in Europe which affects what happens in the US. Not surprisingly, global competition is keen. Japan, small as it is, has shown to the world how efficient and productive the Japanese can be. By 1992, the European Community (EC) will be a major force for the Americans to face. The US is lagging behind; it needs to take on the challenge and improve its performance in order to better compete with the rest of the world. The American educational system needs to be restructured; and more specifically improvements need to be made in foreign language teaching. Although technology is part of the problem, it is also in technology that part of the solution lies. Interactive Videodisc is a new technology that can empower the language teacher and learner, and help improve the process of teaching and learning.

Authentic Language: Interactive videodisc brings to the teacher and students in the classroom (to the learner at a workstation) a wealth of audiovisual materials in authentic situational contexts in the target language. This wealth of materials on disc is immediately accessible to the teacher. The teacher can design the lesson to take advantage of these materials at its simplest form (level one as mentioned above).

User involvement and participation: Effective second language teaching is a dynamic interactive process with or without technology. The use of IVD enhances that process for the teacher and the learner. The learner does not remain passive; he/she has to interact with the courseware requiring a response from the learner to progress through the program.

Self-paced learning and user control: Important to repeat is an obvious axiom of the learning process: learning takes place at the speed of comprehension which varies with each learner. Since each person learns at his/her own pace anyway, it follows that if the pace of instruction were at the pace of the learner's ability, under learner control, then improved learning and improved retention would occur. Interactive videodisc can offer such

¹ Please refer to C. Doughty's article (p. 1 in this collection) for more in-depth information.

an environment. At an individual computer based workstation, the learner controls the system and the screen output. Depending on the courseware design the learner has many choices to make, controlling to varying degrees, the content. Such an environment is powerful because it can be self-directed and self-paced.

Audiovisual teaching and learning: A language course is a series of complex events and skills. Such a course can be challenging to teach because it necessitates varied modes of communication: oral, aural, visual, written and cultural. A language learner must acquire a degree of proficiency in vocabulary, grammar, pronunciation, speaking, listening comprehension, spelling, writing, reading, non-verbal gestures, comprehension and culture. What technology or human expert could accomplish the above perfectly for every language student? None and no one. An interactive videodisc system can help. In the classroom and in the resource center an interactive videodisc system can offer an audiovisual environment to assist the learner to address some skills more efficiently and effectively. To address the varied language skills and personal learning styles, varied methods of language teaching and learning interactions are necessary.

The learner sees, hears, and does: Most people seem to retain better and longer what they learn through experience with their senses. Human beings learn by imagery. Much of today's communication, today's teaching and learning can take place electronically. A new and powerful image-based code has been created and has evolved since the advent of computers and video. The written code (i.e. the printed word) is only 400 years old. For thousands of years before the printed word, communication and instruction took place orally and visually by role playing and with picture drawings (White, 1986).

An IVD language program can show the learner how authentic language is used in context, explain to the learner the what and the how of the context; and help the learner comprehend. With the guidance of the teacher and/or the guidance of a well-designed system, an IVD language program can help the learner say, perform, and apply the content through varied approaches such as tutorials, comprehension questioning, drill and practice, problem solving and simulation. Today's electronic equivalent to role playing in the language classroom is simulation in a level three system. It is a powerful technique for teaching and learning (think of all the video games our kids enjoy!). A benchmark project in simulation is MIT's *Aspen Movie Map* project, another under development, also from MIT, is the *Direction Paris* project as part of Project Athena.

Immediate feedback: An interactive videodisc system can give the students immediate feedback. The students know how well they are doing, know when they make a mistake and have the opportunity for repeated trials and remediation.

Tracking and affordability: In addition to the flexibility and the patience of a computer based IVD system, IVD can give the instructors management and tracking tools for large numbers of learners: the learner time, choices made and activities utilized (drills and testing) at the station can be recorded for administrative, grading and record keeping purposes.

IVD, for large numbers, over a period of time, is affordable. A computer/videodisc workstation may cost as little as \$5,000.00 and more and more discs are becoming commercially available and affordable. New players such as the Pioneer LD-V8000 allow for the needed frame accuracy and control which means that numerous commercial movies on disc can be used for interactive teaching and learning. In addition, to facilitate design and development of materials, there are a variety of authoring systems and languages available; many of which require little programming knowledge (See Glossary--authoring systems and languages).

The changing role of the language teacher: If the learner has access to IVD quality courseware to use at the language resource center, such an IVD environment can assist and enhance the teacher presentations of language materials. The teacher's time during class becomes free to focus on applying and manipulating the language, on speaking and writing vs drills and explanation. The teacher becomes free to devote more attention to particular learners' problems. Offering tools to the teacher gives the teacher the option to design and develop instructional computer-based materials for the students. Once an IVD system is in place it saves a lot of time and labor for the teacher who does not have to deal with many different machines to accomplish similar goals. In the language resource center, the teacher's role is changing slowly to a facilitator, a monitor of the learning station; in the classroom, the teacher is becoming a diagnostician, a prescriber and evaluator (Gale and Brown, 1985).

How much does a language laserdisc cost? Prices do vary depending on format and extent of the design and content. For example, the CLV, extended play of Cocteau's Classic romantic drama *Beauty and the Beast*, with subtitles, from the Janus Collection, costs \$59.00; CALICO's *German Gateway*, CAV, standard play, German course, costs \$195.00 (see Appendix).

In conclusion, for today's teachers and learners, an IVD system permits affordable, user-controlled, effective study of authentic language events and is thus an extremely valuable tool.

A Ventura College French Teacher Sees the Promise of Interactive Videodisc

In the Fall of 1983, in between my teaching schedule at Ventura College, I took my first computer class entitled, "Introduction to Information Systems". During the semester the students had to go to the computer laboratory to do a few assignments. In the course of the semester, I was enjoying so much the dialogues I was having with the computer programs and the control that I, as a student, had in regard to the pace of the lesson, that I started to think about the use of the technology with my students of French. I envisioned the computer as a presentation tool for the teacher in the classroom as well as an individual station for self-paced learning for the student in the language lab.

There were though, a few missing elements necessary for language learning. The computer could not provide the visual, sound and human interactions so significant in a language learning environment. Video could perhaps supply the missing links. The question became, how can a teacher incorporate effectively the interactivity, speed, and versatility of the computer with the rich presence of video? Researching the topic, I found that what I was looking for; it was called Interactive Videodisc (IVD). In 1984, it was an emerging technology. The technology sought was not videotape, but rather a shiny 12-inch or 8-inch record, containing picture and sound information read by a laser beam and displayed on a video screen; this optical disc was called a laser videodisc. Feeling overwhelmed and ignorant yet elated, I forged slowly ahead as best I could. Unfortunately, like most teachers who work hard at teaching, I had very little time for learning about this promising technology.

Realizing I had much to learn, I proceeded to register for the two most important learning events of my newly found orientation in teaching: Designing and Producing Interactive Videodisc from the Nebraska Design Production Group at the University of Nebraska, Lincoln; and the Computer Assisted Language Learning and Instruction Consortium (CALICO) Symposium (see Appendix). I learned. Everything was new to me. Inspired, I took the initiative to get involved. The year was 1984--a year full of exciting discoveries and professional growth.

I started to dream about a well-designed computer program and video motion production with authentic speech and how much this combination could do for teaching and learning a foreign language. Video simulation techniques with native speakers could give language students the closest experience to being in the country itself. If only a specialist in design, a specialist in video production, and a specialist in computer programming could help me do what I envisioned, I would have the greatest language courseware! Right! I was dreaming. I was about to face many problems, the biggest of which were know-how, cost, time and administrative support.

Persistent effort paid off. Two years later, I had produced the videodisc *Interactions Audio-Visuelles*, and the following year, with the support of the Humanities Division of Ventura College and a small grant from the Fund for Instructional Improvement from the State of California, the French department was the proud owner of one interactive workstation with exploratory courseware for students of French.

Today, at Ventura College, we have an Educational Technology (E.T.) committee and are currently planning a campus wide E.T. center for learning and teaching, research and development. It is only a beginning! I envision now the eventual merging of the classroom and laboratory environments where electronic, image-based multimedia stations are common, where the focus is no longer on the tools but on the quality of the content and its design to accomplish our ultimate goal of improved human communication.

Summary

Doug Renwick, Dept. of Mathematics, Humboldt State University, Arcata, CA wrote, as he returned, unused, the French laserdisc *Interactions Audio-Visuelles*, loaned to the university: "We have found that the most difficult aspect of moving interactive video technology into the university environment is to train faculty to begin to express themselves with the medium." Indeed training, life-long learning and continuous renewal are required today. A new age has dawned in education. Educators who take the initiative and make the consequent commitment to reconceptualize teaching and learning by adopting new technologies into the curriculum must be aware that one of the significant aspects to be addressed to ensure continuous, progressive technology transformation is the degree of the individual's commitment. The changes are so rapid and so complex that educational institutions, State and Federal Departments of Education, as well as private organizations should encourage, facilitate and support those committed individuals. Not recognizing the changes currently taking place in how we communicate and share information, will continue to make us reactive. "(Schools)...will lose their position as the major educators within our society and their place will be usurped by museums, libraries, shopping centers, and offices" (White, 1986, p. 1).

IVD technology, and the rest of today's multimedia information technologies, require both conceptual and experiential learning. The hardware will continue to change. However, the concepts of interactivity, self-paced learning, simulation and progressively more expert software on optical media are here to stay. "Information today is fluid and rapidly changing...Our concept of information itself must be redefined... Among the radical changes that the new technologies are bringing, is a new language....Imagery is the language of the information age" (White, 1986, p. 4).

We, as educators, must learn to decode this new language in order to educate better. The sooner we get involved the sooner we'll learn to evaluate the quality of that new code to help our students develop that ability. Our commitment to action is a requisite on our part if our students are to command their full potential; for we have to ensure that this new code is used intelligently, ethically and caringly. As language educators, we have an edge since we understand what needs to be done. We need to reconceptualize ourselves, help our institutions do so as we help transform and are being transformed by the technological revolution.

American education is indeed pointed to an exciting future, as John Sculley, Chairman of Apple Computer, Inc., writes in the Foreword of *Interactive Multimedia* (Ambron and Hooper, 1988, p. 340): "The multimedia learning environments are stimulating, exciting and within reach. They represent an expansive vision, but not a distant one. They are the tools of a near tomorrow, and like the printing press, they will empower individuals, unlock worlds of knowledge, and forge a new community of ideas."

Appendix

Useful resources ²

I. Associations: As mentioned above, continuous learning is a must today. One of the ways to keep current in this field is by attending and actively participating in educational and professional associations. The following associations offer invaluable resources; I, personally would like to recommend two: CALICO and IICS. I can't begin to explain how useful they have been to me.

CALICO, 3078 JKHB, Brigham Young University, Provo, UT 84602; (801) 378-7079. Dr. Frank Otto, is the director of this world wide consortium. CALICO is the acronym for Computer Assisted Language Learning and Instruction Consortium. Since 1983, CALICO has been recognized as an international clearinghouse and leader in computer assisted language instruction. As of this writing, there are seven Special Interest Groups (SIGs): Artificial Intelligence SIG, Computers in the Classroom SIG, Foreign Character Fonts/Asian Languages SIG, CD-ROM SIG, Courseware Development SIG, Interactive Audio/Video SIG and Hypermedia SIG. The membership is composed of leaders, innovators and experts from academia, business, manufacturing and government. CALICO offers many programs and activities, among which are: the CALICO Journal, the CALICO Monograph series, Software/Courseware (the first package is "German Language and Culture: An Audio/Videodisc Approach"), the CALICO Audio Bookshelf (CAB), the CALICO Summer Institute, the CALICO Annual International Symposia.

The International Interactive Communications Society (IICS), 2120 Steiner Street, San Francisco, CA 94115. IICS has numerous local chapters throughout the world; it is an association of communications industry professionals dedicated to the advancement of interactive technologies. The Society provides a forum for users and vendors to share ideas, applications and techniques for the effective use of interactive media. Memberships are available to individuals, institutions and corporations and offers regular meetings with presentations of interest to members, a monthly Newsletter, the IICS Reporter, a quarterly Journal, Interact and other additional benefits.

Audio Visual Communications (AVC), is a well established, recognized association of audio visual professionals; one of their important annual activities is a competition of audio visual productions called the Cindy awards; thanks to Jim Griffith, President of Media Learning Systems, Interactive Video is an established category of the annual competition of the association. For information about the competition contact Jim Griffith at Media Learning Systems, 120 West Colorado Blvd, Pasadena, CA 91105; (818) 449-0006

The Consortium for Language Teaching and Learning: 11 private research universities--Brown, the University of Chicago, Columbia, Cornell, Dartmouth, Harvard, MIT, the University of Pennsylvania, Princeton, Stanford and Yale--have been collaborating since 1986 to strengthen foreign language instruction. The group has three main goals: 1) to develop curriculum materials in the less commonly taught languages, especially at the more advanced levels; 2) to promote teacher training; and 3) to study and adapt technology. For further information, contact Peter Patrikis, Consortium for Language Teaching and Learning, 111 Grove Street, P.O. Box 2497 Yale Station, New Haven, CT 06520-2497; (203)432-0590.

The Interactive Exchange (TIE), is published monthly by Future Systems Inc. TIE is distributed free of charge to subscribers to the Videodisc Monitor, and members of the International Communication Society (IICS), Special Interest Group for Optical Media in Education and Training (SIGOMET), and Interactive Video Industry Association (IVIA). Individuals who are not members of any of these groups may subscribe to TIE at \$ 15.00 per year. Future Systems Inc., PO Box 26, Falls Church, VA 22046-0026; Shipping: 5929 Lee Highway, Arlington, VA 22207; Phone (703) 241-1799.

²This list of resources is not intended to be comprehensive.

The International Association for Learning Laboratories (IALL), C.P. Richardson, executive Director Language Laboratories, Ohio University, Ellis Hall Athens, OH 45701-2979: workshops and training resource.

Nebraska Videodisc Design/Production Group, University of Nebraska, Lincoln, 1800 North 33rd Street, Lincoln, NE 68583, (402) 472-3611. Director Ron Nugent. The Group offers annual symposia and workshop on IVD. The Nebraska Interactive Videodisc Awards (Nebbies): annual awards are given for outstanding videodisc projects by the Group. Presented at the annual Symposium Awards Banquet, the awards are given in six categories: Best Consumer Achievement, Best Data Bank Achievement, Best Educational Achievement, Best Industrial Training Achievement, and Best Overall Achievement, Best Instructional Use of Videodisc in K-12 Education.

Project for International Communication Studies (PICS), Consortium and Network: Directors, James Pusack, Rick Altman, Sue Otto; the Project was inaugurated in 1982 at the University of Iowa; its purpose is to foster the use of authentic foreign television materials in foreign language and international studies. The consortium, composed of BYU, Clark University, Middlebury College and Ohio University, laid the foundation for a nationwide publication and distribution system for international television; the network draws colleagues across the country to acquire rights to material abroad, select programs, develop ancillary materials, publish video packages, including print and computer-based support and widely distribute the products on a non-profit basis. The project's first videodisc, *Télé Douzaine*, will soon be available for distribution.

Society for Applied Learning Technology (SALT), 50 Culpepper Street, Warrenton, VA 22816; (800) 457-6812. The Society was founded in 1972 to provide conferences and publications in applied instructional technology.

Minnesota Educational Computing Corporation (MECC), 3490 Lexington Ave. North, St. Paul, MN 55126; (612) 481-3670.

Applied Video Technology, Inc., 5118 Westminster Place, St. Louis, MO 63108.

Institute for the Transfer of Technology to Education/ National School Board Association, 1680 Duke St., Alexandria, Virginia 22314. Since 1984 this organization has worked to bring the power of the videodisc medium to the attention of schools, teachers and students. The organization made a disc in 1986 entitled *A sampler of Videodiscs for the Classroom* and in 1987 wrote the book, *Should Schools use Videodiscs?*

Sony Video Institute of Applied Technology, 2021 North Western Ave., P.O. Box 29906, Los Angeles, CA 90029; (213)462-1987; if you are interested in video education from video production to editing to laserdisc design and development, the Institute Presents over 130 workshops each year at over 24 locations across America.

Office of Technology Assessment (OTA), is a government office involved in the assessment of the use and application of high technology in teaching and learning in our schools. *Power On* is a recently published report by OTA. To get the report send \$11 to: The Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325.

Association of Educational Communication and Technology(AECT), 1126 16th Street NW, Washington, DC 20036.

II. Hardware/software developers/distributors:

Allen Communication, 140 Lakeside Plaza II, 5225 Wiley Post Way, Salt Lake City, Utah 84116, (800) 325-7850, (801) 537-7800; they are among the pioneers in IVD, IVD interfaces, IVD systems, and courseware. Quest is Allen Communication's popular authoring language.

Optical Data Corporation, 30 Technology Drive, Warren, NJ 07059, (908) 668-0022; ODC is among the pioneers of IVD, specializing in the Apple II and Macintosh IVD systems and courseware.

Ztek, P.O. Box 1968, Lexington, KY 40593; (606) 252-7276, (800) 247-1603; distribution company specializing in IVD systems and courseware for education.

Videodiscovery, 6542 50th N.E., Seattle, WA 98115; (206) 285-5400; develops and distributes videodiscs in science.

The Voyager, 1351 Pacific Coast Highway, Santa Monica, CA 90401, (213) 451-1383; Fax (213) 394-2156; (800) 446-2001; in CA (800) 443-2001; IVD publishing company, specializing in laserdiscs and MacintoshTM hypercard stacks.

Applied Interactive Technologies, 621 Lakeland East Drive Jackson, MS 39208, (601) 939-2987.

Hoffman Educational Systems Inc., 1720 Flower Ave., Duarte, CA 91010, (800) 826-8377

C.E.L. Resources, 515 Madison Ave., Suite 700, The Video Encyclopedia of the 20th Century, New York, NY 10022; (800) 235-3339

LaserDisc Corporation of America Inc., 200 W. Grand Ave., Nonviable, NJ 07645, (201) 573-1122

Merrimack Education Center, 101 Mill Road, Chelmsford, MA 01824, (617) 256-6254

Systems Impact, Inc., 4400 MacArthur Blvd., NW, Suite 203 Washington, D.C. 20007, (800) 822-4636

InfoWindow Educational, IBM Corporation, 3301 Windy Ridge Parkway, Marietta, GA 30067, IVD systems

Pioneer Communication of America Inc., 600 E. Crescent Ave., Upper Saddle River, NJ 07458-1827, (201) 327-6400; (800) LASER-ON, specializing in laserdiscs, laserdisc players.

Whitney Educational Services, 415 S. Eldorado St., San Mateo, CA 94402; (415) 340-9822; courseware services.

Applied Learning International, 1751 W. Diehl Ave., Naperville, IL 60540, (312) 369-3000

III. Recommended books and journals:

Athelstan Newsletter: Newsletter On Technology And Language Learning; Editors: Dr. Michael Barlow and Dr. Suzanne Kemmer. P.O. Box 8025-N, La Jolla, CA 92038-8025, (619) 552-9353.

The Educator's Handbook to Interactive Videodisc, Ed Schwartz, Association for Educational Communication and Technology (AECT), 2nd edition, 1988.

Interactive MultiMedia: Visions of MultiMedia for Developers, Educators, and Information Providers, Edited by Sueann Ambron and Kristina Hooper, foreword by John Sculley. Microsoft Press, 1988. Media Lab. Massachusetts Institute of Technology, Cambridge, MA, 1987

Teaching Language in Context. Omaggio, Alice, Boston: Heinle & Heinle, 1986.

Interactive Video, edited by Eric Parsloe, researched by Signe Hoffos and the EPIC team, 1984. Sigma Technical Press, 5 Alton Road, Wilmslow, Cheshire, U.K.

The Videodisc Book: A Guide and a Directory, Rod Daynes and Beverly Butler, John Wiley and Sons Inc., New York, N.Y. 1984.

- Videodisc and Microcomputer Courseware Design.* Michael L. DeBloois, Educational Technology Publications, Englewood Cliffs, New Jersey 07632, 1982.
- Practical Applications of Research in Foreign Language Teaching.* Lincolnwood, Ill.: National Textbook Co., 1983
- Power On.* Office of Technology Assessment (OTA) report, 1988, Office of Technology Assessment: OTA Superintendent of Documents, Government Printing Office, Washington, DC 20402-9325.
- CALICO Journal.* 3078 JKHB, Brigham Young University, Provo, Utah, 84602; (801) 378-7079; the quarterly, professional journal serves as the chief means of information distribution for CALICO; it has been recognized as the international clearinghouse for applications of high technology to the teaching and learning of languages.
- Interact,* The IICS Journal and IICS Reporter, Newsletter, c/o John Ittelson, College of Communications, Communication Design Department, California State University, Chico, Chico, CA 95929-0504
- The Videodisc Monitor.* P. O. Box 26, Falls Church, VA 22046; (703) 241 - 1799; monthly industry journal, covering application, innovation and technology within interactive video, compact disc and related fields.
- Academic Computing.* P.O. Box 532, McKinney, TX 75069, covering computer use in higher education.
- CD-I News.* Emerging Technologies Publications, LINK Resources Corp., 79 Fifth Ave. New York, NY 10003 (212) 627-1500
- Instructional Delivery Systems.* 50 Culpepper Street, Warrenton, VA 22186, (703) 347-0055, a bimonthly magazine devoted to the issues and applications of technology to enhance productivity in education, training and job performance.
- Interactive Instruction Development.* Comtech, 50 Culpepper Street, Warrenton, VA 22186; quarterly publication by Communicative Technology Corp. (Comtech) in Cooperation with SALT; focuses on the issues related to the development of interactive instructional systems and courseware.
- T.H.E Journal.* Technological Horizons in Education, is published 10 times per year by Information Synergy Inc. 2626 S. Pullman, Santa Anna, CA 92705; (714) 261-0366
- LaserWorks.* the Voyager Company Newsletter which focuses on the Voyager's interactive software and the Criterion Collection of laser videodiscs.
- Association of Departments of Foreign Languages (ADFL).* Denise Knight, editor; 10 Astor Pl, New York, NY 10003.
- Multi-Media Computing and Presentations.* Journal for computing and media professionals; Nick Arnett, Editor; Tim Bjarin, Publisher. Creative Strategies Research International, 2900 Gordon Ave. Suite 100, Santa Clara, CA 95051; (408) 245-4750.
- Optical Information Systems.* Meckler Publishing, 11 Ferry Lane West, Westport, CT 06880
- The Videodisc Connection.* A free directory of service suppliers; 3M Optical Recording, Building 223-5-01 3M Center, St. Paul, MN 55144.
- CD ROM Librarian.* Meckler Publishing, 11 Ferry Lane West, Westport, CT 06880.
- DiscTopics.* Pioneer Communications of America, Inc., 600 East Crescent Avenue, Upper Saddle River, NJ 07458-1827.
- Video Computing.* P.O. Box 2401, Satellite Beach, FL 32937.
- Learned Information Publications.* 143 Old Marlton Pike, Medford, NJ 08055.

IV. Catalogs of laser videodiscs commercially available

LaserDisc Corporation of America, 200 West Grand Ave., Nonviable, New Jersey 07645, catalog of Pioneer laserdiscs and CD's.

Ziek, 595 E. 3rd Street and Midland Ave., Lexington, KY 40508; (606) 233-7186; distribution company specializing in IVD systems and courseware for education.

The Voyager, 1351 Pacific Coast Highway, Santa Monica, CA 90401, (213) 451-1383; Fax (213) 394-2156; (800) 446-2001; in CA (800) 443-2001; IVD publishing company, specializing in laserdiscs and Macintosh hypercard stacks.

V. Commercially available CAV discs for languages

There are many movies (American, French etc.) which have been transferred to laser videodiscs and can be used for authentic language learning and teaching; please check with above listed catalogs.

Dans le Quartier St Gervais. 2 discs, (30, 60 minutes), beginning and intermediate French, Janet Murray, Director, Athena Language Learning Project, MIT 20B-231, Cambridge, MA 02139, (617) 253-2094.

Eight Easy Pieces: Motivating introduction to business for courses in French or German. 60 minutes. \$150. PICS, The Project for International Communication Studies, 266 International Center, The University of Iowa, Iowa City, Iowa 52242, (800) 373-PICS.

Télédouzaine. Features from Antenne 2 selected to motivate elementary to intermediate level French language students. 60 minutes. PICS, The Project for International Communication Studies, 266 International Center, The University of Iowa, Iowa City, Iowa 52242, (800) 373-PICS.

Nachrichten I. 14 television news features, motivational segments for German language students, 30 minutes. PICS, The Project for International Communication Studies, 266 International Center, The University of Iowa, Iowa City, Iowa 52242, (800) 373-PICS.

German Gateway. German language and culture course, 60 minutes, beginning and intermediate level, \$195.00, CALICO, 3078 JKHB, Brigham Young University, Provo, Utah, 84601, (801) 378-6135, Fax (801) 378-6533.

The Language Learning Disc. Training in how to learn a language, 60 minutes, 5 diskettes for IBM system, 2 diskettes for Sony View system; \$995; Joan Rubin, Department of Slavic Languages and Literatures, Gelman Library 625, George Washington University, Washington, D.C. 20052; (202) 994-6335.

Earth and Space. English, Infowindow IBM system; Media Learning Systems, 120 West Colorado Blvd, Pasadena, CA 91105; (818) 449-0006.

Raiders of the Lost Arc interactive software for English listening comprehension; Junius Bennion, BYU 2113 JKHB. Provo, Utah 84602.

Deutsch in Deutschland. beginning and intermediate German; repurposing of the German Gateway disc on InfoWindow by Curtis Swanson, Dept of Foreign Languages, CSU, Fullerton, CA 92634, (714) 773-2749.

VI. Projects just completed or near completion

No Recuerdo. intermediate Spanish, 60 minutes, Janet Murray, Director, Athena Language Learning Project, MIT 20B-231, Cambridge, MA 02139, (617) 253-2094.

Luis Needs a Job. English, Martha Andrews Gan, 15 Lansing Drive, Nashua, NH 03062, (603) 888-3927.

The Maid, Stephusband and Archimedes. Hebrew, 2 two-sided discs; Frank Otto, CALICO, 3078 JKHB, BYU, Provo Utah 84601.

Quechua Simita Parlana I. one disc, beginning Quechua; Clifford Behrens, Latin American Center, 10343 Bunche Hall, UCLA, LA, CA 90024.

Survival Spanish Interactive. beginning Spanish, Miami-Dade Community College, 11011 S.W. 104 Street, Miami, Florida, 33176, (305) 347-2158.

Intensive Inductive Spanish, 1 two-sided disc, beginning Spanish, Grant Reese, Department of Foreign Languages, Utah State University, Logan, Utah 84322-0720, (801) 750-1206.

Spanish I and II. 3 sides, beginning and intermediate Spanish, Lt. Colonel Mike Verano, United States Air Force Academy, Colorado Springs, CO 80840, (719) 472-2840.

Air Force Academy Seven Languages Disc. Prototype disc in Spanish, French, German, Chinese, Japanese, Russian and Arabic; beginning and intermediate; Lt. Colonel Mike Verano, United States Air Force Academy, Colorado Springs, CO 80840, (719) 472-2840.

References

- Ambron, S. & Hooper, K. (Eds.) (1988). *Interactive MultiMedia*. Redmond, Washington: Microsoft Press.
- Gale, L. & Brown, B. L. (1985). A theory of learning and skill-acquisition applied to interactive video: Activities at the David O. McKay Institute, Brigham Young University. In J. B. Gillespie (Ed.). *Studies in Language Learning: Special Issue on Video and Second Language Learning* (pp. 105-114). Urbana-Champaign, University of Illinois.
- Griffith, J. (1988). What is interactive video? *IICS Newsletter*. Los Angeles Chapter 4.6.
- Nugent, R. (1988). *Levels of interactivity*. Design and Development Group. Lincoln, Nebraska, 5.3.
- Saint-Leon, C. B. (1989). The case for authentic materials on videodisc. *CALICO* 6.(2) : 27-40.
- White, M. A. (1986). *An Educated View of Technology*. Columbia University, New York.

Teaching and Learning Languages with Interactive Videodisc

Mylène Garrigues

Centre International d'Etudes Pédagogiques

Sèvres, France

(Translated from French: text by Alice Slaton, figures by Martha E. Slayden)

Introduction

What are the particular characteristics of interactive videodisc which could be used for the teaching and learning of languages? To which specific activities is this tool best suited in the teaching and learning of languages? In this article, we'll attempt to formulate some answers to these two questions.

We shall not belabor here the technical characteristics of the hardware of which an informed public is already cognizant. We shall just say that the capabilities of interactive videodisc are fully in place when interfaced with a computer. It is from this "union" that new ways of content treatment can be exploited, resulting in individualized or collective, self-contained applications.

System Features

The exceptional flexibility of interactive videodisc, and in particular, its random access feature whereby the user is able to access quickly any single frame, leads to interactions that produce an impression of reality, which developers like to emphasize the most. A slow shift is occurring in the content itself, as it relates to the language, from all pre-planned or half pre-planned to all authentic. There are three reasons for this shift:

1. The instantaneous, interactive dialogue that can now take place between the user and the content, confers to the video and audio content a power of realism and strength of recall, going far beyond the power of motion pictures.
2. The possibility of making programmed help readily available to the user and managed by the system, allows us to present authentic situational exchanges without being limited by the level of the target language. A number of developers seem to agree on this point.
3. The possibilities of simulation linked to the branching principle allow the exploration of culture in a manner attractive to the user. The idea of a pleasure stroll inaugurated by the *Aspen Movie Map*¹ is recaptured by several developers of language materials in a cultural perspective (Furstenberg, 1988). The user is able to take a walk in any part of a city where the target language is spoken; the user may then choose to go into a store, speak to the locals, get historical explanations, or look up archival documents, etc. This cultural exploration on videodisc may prove to be even richer than a real visit if the design has any depth.

As an example of pre-planned discs, developers in the Interactive Media Laboratory at the Centre Mondial de l'Informatique et des Ressources Humaines² (CMI) produced a first aid disc, *Les Cinq Gestes Qui Sauvent*. Queried in this program via multiple choice questions, the user sees his/her wrong decisions shown as motion sequences. For example: a man accidentally cuts himself on the leg with an electric saw. Where on the leg

¹A videodisc developed by the Architecture Machine Group at MIT and presented by Nicholas Negroponte in January, 1983, at the "Forum International des Nouvelles Images" in Monaco.

²The World Center for Informatics and Human Resources, an organization, funded by the French Government in the early 80's for the development of educational technology. There, Georges Broussaud, the father of Thomson-CSF's early transmissive videodisc system, directed the development of interactive technologies and programs. Two of the main efforts were the *Peau d'Ane* videodisc program based on the movie by the same name as well as *Les Cinq Gestes Qui Sauvent* (The 5 Life Saving Gestures), both mentioned in this article.

should the user press? Where should the user place the tourniquet? The injured man may ask for water. Should it be given to him? One mistake from the user-medic and the patient can hemorrhage; a wrong gesture and the patient dies. For language-learning activities, one can well imagine the various linguistic multi-path scenarios which could test the comprehension of the learner.

This framework demands specific shots in which the use of the **subjective camera** seems to be particularly appropriate. A character from the story that has been filmed many times using subjective shots will be able, for example, to directly address the user and give different feedback according to the user's decisions. An example of this type of implementation appeared in a videodisc developed in Holland for learning English.³

Although pre-planned videodisc production has distinct advantages, it is also expensive. Thus, authentic materials designed for sequential viewing and a passive audience (ie. films, T.V. broadcasts, etc.) can be transferred onto videodisc, effectively "repurposing" the video. When the user accesses the material through the computer interface with appropriate software, such materials can offer an efficient, self-paced, self-training application at home, in media libraries, etc. The set story line becomes less and less important, even when it's only a series of situations in linear fashion with a beginning and an end.

Using computer-generated graphics and the second audio track, it is possible to bridge the gap between "pre-planned" and "authentic" materials. This approach multiplies the teaching/learning possibilities by increasing the ways learners can interact with the content of the video materials. The fact that each track is randomly accessible, allows even more flexibility in combining video stills, motion video, audio track 1, audio track 2, and text.

Examples of content using two independent audio tracks:

Audio 1, Native language/ audio 2, Target language

Audio 1, Level one/ audio 2, Level two

Audio 1, Slow pace/ audio 2, Fast pace.

Audio 1, Dialogues / audio 2, Narration.

Audio 1, Problem statements-expressions/audio 2, linguistic variations.

Audio 1, Problem statements-expressions /audio 2, problem statements-segments.

Even with re-purposed materials, it is possible for videodisc to place a veritable arsenal of tools at the disposition of the learner, tools that are available instantly, at any moment, from the same media. As an example of controls that work well for this type of program, Figure 1 shows the icon design from the *Peau d'Ane* videodisc on which this author worked six years ago at CMI. It was developed as a prototype and not as a finished product.

The symbols shown in Figure 1 appeared as an overlay of colored buttons at the bottom of the screen while the film was being shown. We called this the "virtual keyboard" because it allowed the user to obtain with a slight gesture (by touching the screen or by using a mouse) any help at the moment it was needed. It should be noted that buttons appeared only when active, according to the level at which the user was at any point in time. Those that were not needed disappeared so as to not bother the user.

The "Play" button (green light) allows the video sequence selected in the "Menu" to play normally, and "Stop" (red light) allows the sequence to be interrupted. The "Audio 1" button provides access to the original dialog of the film (French). Pressing "Audio 2" at any time switches to a narration that is in simpler French, very redundant with the images on the screen. The "Replay" button allows repetition of the phrase in progress from the beginning. Selecting "Subtitles" provides for text to appear in accordance with the audio track that is selected as stated above. The "Text" icon provides access to the full text page that corresponds exactly with the current scene, at which time the "Continue" icon will return the user to the exact point in the film when the "Text" icon

³The SOCAL Project was established at The Institute for Teacher Education, Utrecht, Holland, to create a videodisc for Dutch beginning ESL students. SOCAL is an acronym: SOL (stiching opleiding leraren, CAL: computer aided learning).

was selected. The "Rewind" and "Fast Forward" buttons allow the user to move back or forward in the text pages and "TR" provides an English translation of each of the pages. The user can browse through these pages as well.

In the text pages in French, keywords are highlighted in different colors. Selecting the words provides (according to the user's choice) one or several examples of the word used in other contexts: advertisements, slides, etc. Through various types of oral, written, or iconographic helps, videodisc can provide modular and specific help in gaining meaning from the scenarios.



Figure 1

Linked on the one hand to the goals of authenticity and on the other hand to the significant changes brought about by this new technology, the creation of this type of scenario-made-interactive entails a radical change in logic and design beyond what was originally intended for the video. The scenario the user creates will be the result of navigation throughout the "tree structure" of all of the branching options. This also dictates that responses that address the user's wrong decisions be available. The more extensive and varied these options are, the more in control the user will feel.

For pre-planned video, the principle of user control implies multiple paths with multiple entries and exits according to the user's choice in addition to the controls provided for re-purposed video discussed above. The development of a scenario will be based upon the branching principle through which the user will be free to navigate. With this approach, the greater the number of paths that are available, the greater will be the sense of user control. In reality the users invent their own stories.

Pedagogical Characteristics

The ultimate goal in language teaching and learning is to make the learner "an independent, proficient user" (Dubreuil, 1983, p. 52) thus fulfilling the basic problem which is "to associate sound/meaning and situational experience in interactions" (p. 153).

Dubreuil (1983) describes the possibility of arriving at the meaning through its visual representation, giving as an example the word "dwarf" taken from the audio track of a videodisc from the BBC. The word is pronounced at a moment when the video is showing a close-up of two people in a Van Eyck painting. The learner, who cannot at that point have a size reference, asks for a **zoom out**, which will show the whole painting, thus showing the dwarfed size of the characters in question, in relation to the others. The visual representation

used as a situational statement will then help the learner understand the relationship between "sound and meaning" (p. 153).

Another possible approach to arriving at the meaning through the visual element is the one used in *Peau D'Ane* represented by a right arrow key on the keyboard. When the user presses the key, he/she accesses other visual segments illustrating certain words in different contexts. That type of approach of course is not possible for all the words and all the statements. de Margerie and Porcher (1981) show the limitations of decoding a problem situationally, giving as an example the unavoidable scene of reserving a room at the reception counter of a hotel where different communicative exchanges are possible. As they so rightly observe, "One does not go to the hotel only to reserve a room; one may have to meet someone; one may want to simply drop off luggage, order a taxi, pay a bill...." (p. 52). The fact remains that using interactive videodisc allows the learner specific assistance in decoding the meaning.

It is also possible to lead the learner to more discovery. Thus, as was implemented in *Peau D'Ane*, the focus on key words allows not only their illustration in different contexts but also their exploration lexically or semantically (by giving opposites such as *poser/prendre*, *avoir horreur de/adorer*) or it can show the different parts of the body when the learner is on the word *yeux* or *bouche* etc. (see Figure 2).

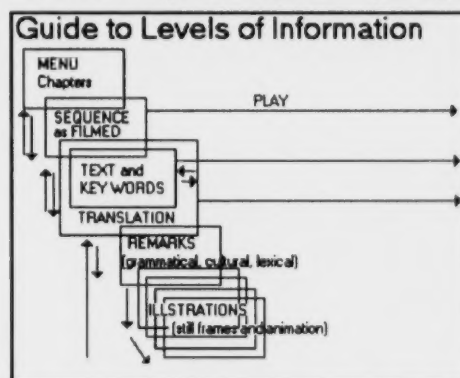


Figure 2

It is essential to point out that there are numerous options for this kind of investigative learning. They are appropriate and even essential for increasing the autonomy of the learner in guiding his or her own learning.

A Revival in Learning Methods

By its new pedagogical architecture that allows the management of audiovisual material, interactive videodisc is part of a true pedagogical revolution. Pushing aside decades of compartmentalized learning, in discrete exercises or drills (vocabulary, grammar, etc.), it places under the control of the learner a multisensory, hypertext environment which can be exploited without a pre-established sequence, with an immediacy that is able to impart to the learner the will to try anything at any moment. In other words, learners learn how to learn at the same time they are learning.

The inclusion of the concept of **hypertext** in materials design and development would allow considerable improvement or revival in methods for learning and would permit a close correspondence between the motivation of the learner and the type of acquisition proposed here.

One could, for example, implement a type of acquisition modeled after the graphic representation method of mental association proposed by A. Moles (1971) under the term of "constellation of attributes" (see Figure 3). The user would search out or reference sample utterances or situations from the association of ideas that are linked to a term or to a concept provided, rather than through a particular grammatical or lexical progression. "One sees the configuration as one groups the attributes around the central concept, at closer proximity as the association is more frequent and immediate" (p. 162).

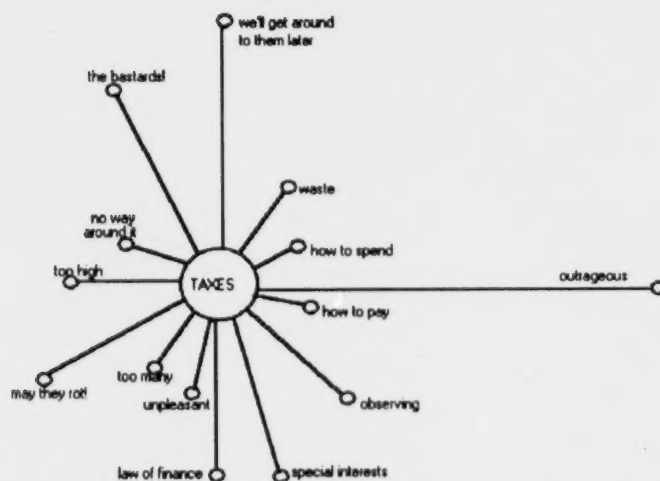


Figure 3

"One observes that the number of concepts suggested in this way does not exceed 30 to 50, denoting a limit to the mind's ability to associate ideas" (Moles, 1971, p. 16). This type of conceptual approach could be useful in the study of culture just as well as in linguistics and even para-linguistics (gestures, expressions, etc.).

Components in the Development of Language Skills

The four language skills usually thought of as being developed in language learning are organized according to the following two groups: 1) written production and oral production and 2) written comprehension and oral comprehension.

What can interactive videodisc contribute in this area?

Production: In terms of oral production controlled by computer, it is certain that interactive video does not offer much; affordable, speaker-independent voice recognition is yet to be. The user can actually repeat or translate information orally at the request of the system, but the system cannot manage nor control the correction of that production. In the *Montevideo* project this oral production was recorded on a cassette and the learner was able to compare his or her production with the recorded one (de Montgóméry, 1984). We are not addressing certain types of waveforms (*mélographe*) that allow a limited control of the oral production: the intonation is visually represented by a curve on the screen. Nor are we considering the oral production caused by a situational visual in the classroom where that visual could be used as a catalyst or a deciphering project.

As for written production, one should note that most videodisc-based programs avoid it. When it is included, it is in general morphosyntactic training rather than real production exercises. This is easily understood. The morphosyntax involves a code (ie. the language), however, the statements are part of an open system (ie. words).

The use of interactive videodisc does not yet solve the language analysis problems, a "soft" science among many.⁴ Without good answer processing, there is massive recourse to multiple choice questions to quiz the user or to the use of a "virtual" or symbolic keyboard as employed in *Peau D'Ane*.

Comprehension: This skill (written comprehension but especially oral comprehension) is without doubt the skill that interactive videodisc permits the learner to acquire and can be acquired in the most spectacular format. The availability of branching according to the user's answers, two audio tracks, and programmed help accessible to the user, are the main factors in the development of comprehension.

⁴For a treatment of the issue of answer processing, one should refer to the article "Didacticiels de langue, quelle analyse de réponse" in *Le Français dans le monde* - May-June '87

New Learning Activities

New learning activities will probably emerge with the technological evolution and the use of professional software tools. Thus one can already foresee the situation where subtitles can be created and overlaid on the video by a group of classroom users. The manipulation of software tools that allow subtitling, editing and recombining video sequences, or indexing stills seem to answer rather well the pedagogical demands for individual activities within groups of students.

For our part, during training sessions for Teachers of French as a Foreign Language we have started to use the multi-criteria retrieval software, *Turbo Thesaurus*,⁵ in order to make indexes of stills or motion sequences for the purpose creating lexical files which allow a thematic, non-tree-like search as well as the boolean combination of many keywords (Garrigues, 1988). Work is proceeding using the videodisc, *Emile Comptine*,⁶ which contains auditory and visual material particularly appropriate for this type of use. The inputting of descriptive terms or key-words is made through forms on the screen. In asking the students to create a lexical, image file on clothing, we guide them through their research to look up the exact terms for particular articles of clothing (red pants, leather jacket, etc.) found in video still frames or motion sequences. The more precise their work, the more useful their image databases will be.

This way, vocabulary learning is not done in a vacuum but rather in carrying out a useful project that is both meaningful and motivating. Other groups of students can create the lexical files and image databases for parts of the body, colors, furniture, miscellaneous objects, etc.

After the first phase, looking up objects in the database will yield another way to review the vocabulary. All of the groups will be able to cross keywords of the various lexical categories using logical operators (AND, OR, NOT). For example, crossing the keywords *téléphoner* (action) AND *fauteuil vert* (furniture) NOT *homme* (actor) will allow the learner to access segments where Anne (the heroine of the videodisc) is using the telephone in a place that has a green chair but without a man being present.

The capabilities of interactive videodisc in language are only beginning to emerge through ever so few applications, and not all projects utilize the capabilities in the best way. If these capabilities were sufficiently and appropriately studied, their use would tend to address the gap that exists between the classroom and the technological environment in which today's classroom is found.

Conclusion

The capabilities of interactive videodisc appeal to all pedagogues. Although widely used in training, this technology has made few inroads in education. Cost is the main reason. Those able to finance particular programs are waiting for an increase in the number of videodisc machines in order to insure the viability and profitability of their investment in materials development projects. On the other hand, potential users are waiting for a greater choice of interactive products before committing themselves to a given system. It's the classic "chicken or the egg" syndrome.

⁵*Turbo Thesaurus* is a program distributed by the firm "Logiciel PUSS" and purchased for use in experimental workshops ("Interactive Images") sponsored by the "Ministère de l'Éducation Nationale" (National Education Ministry).

⁶The videodisc, *"Emile Comptine"*, was produced by the TV channel FR3 and the Centre Régional de Documentation Pédagogique in Poitiers, France. It was designed to help cinematographers learn film editing techniques (*montage*).

Some commercial activity on a small scale has occurred in France: two publishers have produced French language videodiscs, Hachette with *Avec Plaisir* and Nathan with *Voyage en Français Interactif*. These two products represent the French publishing industry's first attempt. Given the realities of today's market, the producers have opted not to invest in overly costly interactivity. Although understandable, does their decision not endanger the future development of the medium?

Moreover, the interested public is on the lookout for any new technologies appearing on the market: CD-ROM, CD-I, etc. Unfortunately this situation fosters a wait-and-see attitude that regrettably may remain with us for quite some time.

References

- Dubreuil, B. (1983). Evolution du poste de travail informatisé. *Education Permanente*, 70-71, 1983.
- Furstenberg, G. (1988). Quand une pédagogie rencontre une technologie. *Le Français dans le Monde*, special edition: *Nouvelles Technologies et Apprentissage des Langues*, (aout/septembre).
- Garrigues, M. (1985). Peau d'Ane: Vidéodisque Interactif de Français Langue Etrangère. *Le Français dans le Monde*, 195, (sept.).
- Garrigues, M. (1987). Videodisque et enseignement des langues: Mémoire de DESS (DESS "Applications de la telematique", Paris VII).
- Garrigues, M. (1987). Didacticiels de langue: Quelle analyse de réponse? *Le Français dans le Monde*, 209, (mai-juin).
- Garrigues, M. (1988). Le vidéodisque: Outil de manipulation de la langue. *Le Français dans le Monde*, special edition: *Nouvelles Technologies et Apprentissage des Langues*, (aout/septembre).
- de Margerie, C. & Porcher, L. (1981). *Des Medias Dans les Cours de Langue*, Clé International.
- de Montgoméry, M. P. (1984). Vidéodisque, ordinateur et enseignement des langues. *Les Langues Modernes*, 1.
- Moles, A. (1971). *La Communication et les Mass Media*. Dictionnaire Marabout Université.

A Systematic Approach to the Design of Interactive Videodisc Courseware

Carla J. Meskill

University of Massachusetts at Boston

Introduction

In addition to harnessing the processing capabilities of a microcomputer, interactive video materials design calls for the simultaneous orchestration of text, graphics, still and moving video images and audio sequences. These components are assembled to create learner-system interaction. They are pieces of a multidimensional puzzle that must be made to fit together to form the larger picture.

The power of interactive video as an educational medium depends on the design and implementation of effective learner-system interaction. As a tool to assist the learning of a foreign or second language, the nature of this interaction can vary substantially from somewhat 'classical' interaction--student completion of drills with the system playing the role of corrector and scorekeeper--to more open-ended, student-directed exploration in which students can, for example, probe a linguistic/cultural database in order to solve a problem, play a role or both (Meskill, 1986, 1988). Regardless of how you choose to design this interaction, regardless of how your final product takes shape, much of the thinking, planning and designing for the IVD medium remains the same.

The purpose of this chapter is to outline a systematic approach to designing Computer Assisted Language Learning with Interactive Videodisc (CALL/IVD) materials and to present a structured model of the problem-solving processes needed to manage the features of a multimedia delivery system for the teaching of language.

The Process

The following presentation and discussion of requisite steps and problem-solving procedures for the design of CALL/IVD is an adaptation of the Systems Approach to Instructional Design, a generalized approach to designing instruction for any medium. The Systems Approach acts not only as a guide for the individual designer but also emphasizes the precise articulation of requisite components. This strong emphasis on clarity becomes invaluable when you are required to describe and communicate the many aspects of a CALL/IVD project to others. Such a system, then, facilitates the organization and implementation of instructional design not only at the beginning stages but also at any time during the process when administrators and outside specialists become involved. The following outline and discussion of the approach specifically treat issues concerned when language is the instruction targeted and interactive video the medium of delivery.

Figure 1 represents the phases of the CALL/IVD design process. The process, as the layout of Figure 1 depicts, is a circular, not a hierarchical one. In other words, single "steps" of the process are not treated autonomously nor are they ever thoroughly "complete" until all implementation, evaluation and re-design have taken place. The process therefore demands a mode of thinking that sends one continuously forward, then back, modifying, rethinking, redefining, rewriting until all these highly interdependent considerations fit together and satisfy one another's definitions and requirements.

Each of these phases of the instructional design process will be presented and discussed as distinct and separate entities, yet with continual emphasis on their interdependent nature. It is important to remember that no single phase is ever to be treated autonomously or "completed" until each is reviewed and reconsidered in light of the entire project. The process is one of simultaneously considering, juggling and reconciling a number of issues that feed into and steer the course of CALL/IVD materials design.



Figure 1

(adapted from *The Instructional Design Process*, by Jerold Kemp, Harper and Row, 1985.)

Phase I--The Front End

Know The Medium: Familiarity with the interactive video medium is an obvious prerequisite when you begin to seriously consider undertaking the complex process of designing and implementing IVD materials. Prior to investing the time and mental energies required by the initial stages of the instructional design process, it is highly advisable to have as much hands-on experience with various types of education, training and entertainment systems which use interactive video as possible. Having a solid knowledge of existing and potential forms of interaction and media combinations in the earliest stages of such a project will act as a powerful foundation upon which later thinking and decision making will be based.

Studying commercial CALL software (computer instruction with no videodisc interface) can be a double-edged sword. Exposure may open doors in terms of understanding instructional possibilities but in a very limited way. One should not be fooled into thinking commercial software is representative of all that the computer can do and in turn treat interactive video the same way. The same holds true when looking at video-based (videotape) language materials. Both of these media have their own specific attributes, strengths and weaknesses. Combined into one system (CALL/IVD) these are quite different indeed. Interactive video cannot be viewed as simply Computer Assisted Instruction (CAI) with video nor linear video plus CAI--the medium is unique and demands a unique set of design considerations.

Identify And Articulate Need: A preliminary concern is the identification and articulation of a need for CALL/IVD. The importance of clarifying the need for this kind of instructional material is strong: CALL/IVD projects are extremely demanding in terms of time, expertise and funding. Very often interactive video projects are initiated because one or more people within an institution wish to explore a new technology, not because a specific need for such a project has been clearly identified and articulated. Regardless of the series of events which brought you to the task of creating CALL/IVD instruction, a long, hard look at existing needs of both your institution and the learner to be targeted is essential. These statements of need, in addition to acting as the project's chief rationale, will act as a powerful guide throughout the subsequent phases of the project's design, implementation and evaluation.

The immediate needs of the institution and the learner for whom the instruction is targeted are determined through an information gathering process like that commonly required for curricular design. That is, at the institutional level existing objectives, course syllabi and materials are examined and classes are observed. A study of performance statistics as well as individual student profiles will supply the kinds of information needed to

pinpoint and articulate learner needs and requirements. These defined needs can then serve to support or disqualify the selection of CALL/IVD as the medium of choice at a point early in the design process.

Rationale For CALL/IVD: As in many situations in which foreign language is the area of instruction, motivation is an identifiable need. Therefore, the rationale for choosing the CALL/IVD medium is clear: increase motivation by introducing an engaging multimedia system which, through the power of video, can bring the target language and culture to life.

Often it is the kind of personalized interaction inherent in CALL/IVD, and which is clearly recognized as beneficial to the acquisition of language, that may not be feasible or cost effective by any other means within the institution--too large a class size, individual tutorial not available, etc. Increased time on task, that is, increased opportunity for individual interaction with the target language beyond textbook and/or audiotape is another pervasive need that CALL/IVD may fill. A most compelling rationale for the use of CALL/IVD is that students learning a language can benefit a great deal from exposure to and interaction with native speakers depicted in video sequences. Moreover, providing access to living language in a cultural context along with the opportunity to manipulate and respond to this language stands out as an outstanding system feature that matches the needs of most language learners.

Components Of The Need Statement:

- Identify the proposed target learner.
- Identify their language learning needs.
- Determine whether or not these needs are currently being met by the institution.
- State how CALL/IVD will meet all or some of these needs.
- Match CALL/IVD attributes with stated needs (Rationale for choosing the medium).

Statement Of Goals: Goals of both the institution and the instruction, if well researched and clearly stated, will, like all other components of the front-end analyses, act as a powerful guide.

A goal is a statement which describes in very general terms the desired outcomes of a project. The overall goals of a CALL/IVD project can be divided into two sets: institutional goals and instructional goals.

Institutional goals concern what teachers and administrators wish to see as an outcome of the CALL/IVD instruction. The goal of the institution may be to lower the rate of attrition in foreign languages, improve scores on exit exams or simply demonstrate the viability of the interactive video medium. Or it may be that your institution has acquired interactive video hardware systems and simply would like to see these put to use. These kinds of institutional goals need to be ascertained because such considerations will play a determining role at later stages of design, implementation and evaluation.

Instructional goals can be one or more general statements which describe the type of learning that will take place, be it vocabulary building, for example, or the enhancement of overall communicative competence in the target language. The role of a goal statement is that it reflects and promises to fulfill the instructional needs of the students within the institution as determined in the statement of needs. Thus, the development of statements of needs and goals is often simultaneous and interdependent.

Determine Constraints

Institutional Constraints: At the earliest stages of the design process you must determine the relationship the CALL/IVD project is to have with other existing materials and activities within the curriculum. Duplicating instruction is not desirable. Nor is it advisable to attempt to redefine and possibly undermine what the institution has developed in the way of language curricula.

Beyond working with (rather than against) the existing features of the institution, there are a number of other physical and logistical constraints that need to be considered. The following activities require careful planning: putting the IVD course in place, troubleshooting software, maintaining hardware, supervising student use and,

simply, managing logistics. It does not make sense, for example, to proceed with such a large-scale project if there is not appropriate and sufficient space to house interactive video work stations or if there are no elevators to transport systems between classrooms on different floors. Even projecting the role that internal resistance to "change" (a new technology) will play is important when you look at the institution.

These institutional constraints will come into play again and again during the process of design and will certainly steer the development of the CALL/IVD materials. A statement, therefore, of how the on-line instruction is to take place (time, location, personnel, etc.) and how it will complement the existing curriculum will result from identifying and articulating institutional constraints.

Development Constraints: Funding, time and personnel are clearly constraints within which the development of a CALL/IVD project is confined. However, it is not until you are able to define appropriate instructional and media strategies in later stages of the design process that you can make an accurate analysis of needed resources.

There are two major development constraints, however, that must be addressed up front for computer plus video instruction. The first is the selection of hardware and software. Ideally, hardware and software selection takes place once instructional and media strategies have been formulated; that is, when your paper documents and design are complete. Purchase of needed hardware and software tools would then be contingent on their ability to most easily and effectively realize the design.

However if, as in many cases, your institution has already committed to a specific system and/or authoring software package¹, it is essential that you identify the capabilities and limitations of that hardware and software and consider these throughout the development phase.

Second, video production costs are so high that many prototype CALL/IVD projects may be restricted to using existing video and audio sequences. Repurposing or retrofitting video² requires an intense familiarity with existing sequences and functions as an enormous constraint in terms of the development of instructional strategies and media combinations. It is imperative that you seriously consider these two key constraints--existing software and/or existing video. All such limitations should be clearly stated at this point in the process.

If these constraints do not exist for your project, that is, if you have the luxury of choosing your own hardware and software tools and producing original video, an analysis of resources pertinent to later purchase and production will become important when the CALL/IVD design is in place.

Describe Learner Characteristics: As with the development of language materials for any medium, the target learners' life needs and learning preferences are a key concern. For the design of instructional strategies and media combinations, factors such as age, socioeconomic background, degree of acculturation (for second language learning situations), reason for studying the target language (motivation) and attitude toward the target culture play a role. They guide later decision making for the CALL/IVD materials just as they do the development of materials for traditional media. Individualized, multiple media instructional delivery requires some additional analyses:

- Do students have experience with self-directed instruction? With CAI?
- What are student attitudes toward media (i.e., video)?
- Are students adults who might be media illiterate? Or are they kids who have commercial (MTV-quality) expectations?
- What degree of need do students have for a structured learning experience?
- How much prior exposure to native speaker audio have they had? What dialects/accents?

¹See Joel Goldfield's article (p. 91) in this collection for further discussion of this topic.

²See Mylène Garrigues' article (p. 37) in this collection for further discussion of this topic.

Answers to such questions are clearly relevant to the design of materials for a given student population and should be considered when analyzing characteristics of the language learner for whom the CALL/IVD courseware is intended.

Phase II--The Instruction

In the next phase, the general goal of the CALL/IVD course can be refined and translated into specific learning processes and outcomes. The next three stages, analysis of content, analysis of competencies and writing instructional objectives, are highly interdependent as well as mentally demanding.

Determine Content: Content for the proposed CALL/IVD course must be selected and organized according to predefined and carefully articulated elements of needs, goals and constraints. First, by pinpointing needs that are not currently being met by the existing curricula you can select content by pointing out areas that are not otherwise covered or not sufficiently covered through current classroom and/or textbook activities. Second, the predetermined goals of the institution as well as the goals of the proposed CALL/IVD instruction will also help steer the process of chunking and organizing content.

The process of selecting linguistic and cultural content to be treated in the CALL/IVD materials is like that for traditional syllabus design. Skills and items are chunked and organized into a hierarchical series of learning events. Content that the designer feels would best be dealt with using a multimedia system is, of course, priority. If you are repurposing existing video and audio, content will obviously be limited by what sequences are available. An advantage to a repurposing project, however, is that much content chunking is inherent in and therefore limited to what exists in video and audio segments. Selection of topics, situations, functions, structures and vocabulary, then, are dictated by whatever scenes are available on the videodisc being retrofitted.

Language inventories, textbook tables of contents and existing language class syllabi and tests can provide models for grouping or chunking material. When designing instructional materials and activities of any kind for languages, what is to be introduced, practiced, and, in general, worked on by students is thoughtfully chosen and assembled. A useful tool for this not always clear cut process of selection and organization is a simple content analysis tool (below).

Topic:

Situation:

Function:

Structure:

Vocabulary:

Skill(s):

By tentatively plugging in information under any of these titles, a logical chunk of language (a manageable piece of content) eventually emerges based on what the teacher/designer knows about how the target language and culture work. To use this tool, start filling in information anywhere, in any order. One piece, the real conditional in English under Structure, for example, might lead to "negotiating" under Function which might lead to "buying a car" under Situation with "car and sales terminology" under Vocabulary, etc. Again, when repurposing existing audio and video sequences, the 'givens' (what exists on disc) greatly streamline the content analysis process.

Clearly, determining course content is not unlike organizing topics, functions, structure and vocabulary for off-line language materials or activities but, for CALL/IVD materials, the overriding questions become: What elements of the target language and aspects of the target culture are best depicted with video and audio that could not be otherwise depicted or depicted as well? What content can best be exploited to promote student-system interaction thus engaging exposure to and practice in the language?

By employing this content analysis tool and looking at target language inventories, textbook tables of contents and existing course syllabi, linguistic and cultural elements can be selected. The organization of these chunks or "units" will become the basis for later analysis of terminal competencies and their enabling strategies.

Analyze Enabling Strategies: Enabling strategies are pieces or chunks of learning that are requisite to the attainment of a larger competency. A competency is broken down into its component parts as part of the analysis of the learning which is to take place and to assist in the determination of desirable learning outcomes.

In order to best comprehend the steps and rationale for the analysis of enabling strategies, it is instructive to look at how such an analysis is performed in the case of a readily definable instructional problem such as, for example, teaching beginning readers to identify verbs and nouns in a paragraph. In order for it to be taught, the competency must be broken down into requisite parts and represented hierarchically. The following simple analysis is such a breakdown of the competency "Identifying verbs and nouns in a paragraph".

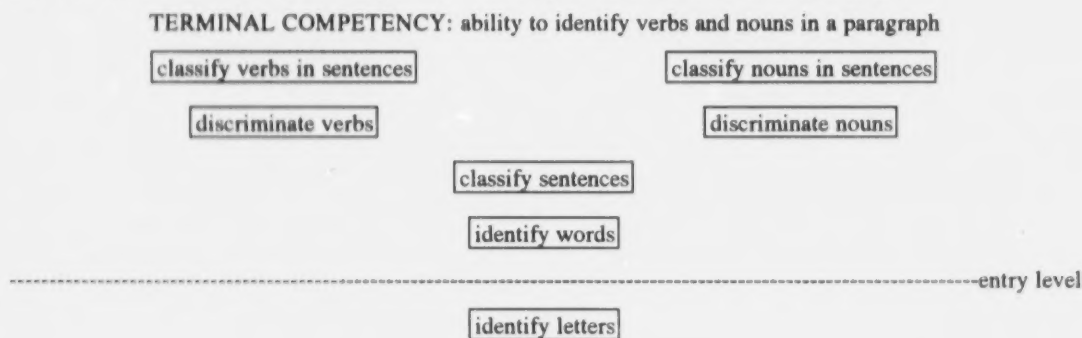


Figure 2

(adapted from *The Systematic Design of Instruction*. Dick and Carey, Scott Foresman, 1978)

Such an analysis, though here very simple in scope, demonstrates the utility of breaking down a competency into its component parts or "enabling strategies" to (1) better see how these parts fit together, the order in which the requisite skills are to be assumed (2) to later determine an instructional objective for each part as an isolated yet, at the same time, interdependent piece of the larger competency.

Note that in this example a determination is made as to what entry-level strategies are considered prerequisite to the actual instruction. These are below the dotted line labeled "entry level". In other words, beginning reading students should be competent in the enabling strategies listed below the dotted line. Anything above the line is then considered to be part of the instructional unit on identifying verbs and nouns in a paragraph.

In the late 1980's it is less often the case that we want students to simply practice and memorize discrete units of structure and vocabulary. It is more often what we can teach students to DO with the language in a meaningful way that concerns us. Though the former is by far the more simple as far as analyzing enabling strategies, it is the latter which a multimedia, computer controlled environment can best address. Stating enabling competencies for learning vocabulary items, for example, is fairly simple:

TERMINAL COMPETENCY: increase student's mastery of concrete nouns in English by five items

recall correct English noun given visual cue

associate English noun with visual representation of same x 5

-----entry level

associate English words with corresponding visuals

spell English words correctly

recognize English words

Figure 2a

The rationale for choosing a multimedia system to deliver this particular component of simple vocabulary building instruction is questionable, as a paper/picture-based activity is likely to be more cost effective and an equally appropriate means of delivery. If self-paced instruction with quick feedback on correct and incorrect answers has been determined as a desirable attribute given the stated needs and goals of the program, it may be determined that a microcomputer with graphics and audio capabilities (no videodisc) is the right choice. If the stated needs and goals for the project indicate that understanding such vocabulary items in a dynamic cultural context is desirable, then a multimedia learning environment such as CALL/IVD should be seriously considered.

Let's assume that the stated needs, goals and learner characteristics as well as the analysis of existing curricula and the course content indicate an approach to vocabulary teaching that emphasizes the integration of topic, structure, function AND vocabulary as its answer to teaching language for overall communicative competence and that it has been tentatively determined that these language features can best be treated using a multimedia system such as interactive video. Special emphasis has been placed on the auditory capability of such a system to train aural comprehension. Training language students to make use of non-verbal clues has also been identified as among the system's capabilities that can be exploited for this particular group of learners. If this is the case, these elements, once selected and organized during the content analysis stage, are also broken down into competencies and enabling strategies.

If the goal of the materials is to improve students' ability to comprehend the target language and as a result of the content analysis, understanding and responding to requests in the target language (English will be used here) has emerged as one manageable chunk of content, a number of components and enabling strategies must be identified as prerequisites for such a competency. The following is a list of content components selected for the Respond to Request competency:

Content components:

topic	situation	function	structures	vocabulary
On the job	In an office	responding to requests	Will/would you...? Can/could you...? Never mind ...ing. Forget about ...ing.	1) file reports type letter call Ms. -- copy forms 2) this, that, these, those, the, please

As with the vocabulary item example, to determine the enabling strategies for the "Request" competency the integration of these components again requires analysis. An analysis of the Request competency, then, might look like the following:

TERMINAL COMPETENCY: ability to respond appropriately to simple requests made by an employer in an office

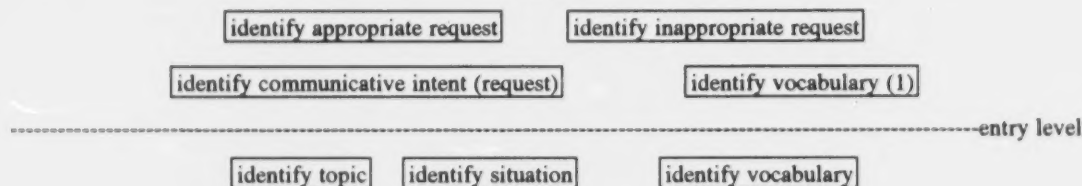


Figure 2b

Constructing Objectives: Once an analysis of the competency has been performed and its enabling strategies graphed out, you can begin to compose instructional objectives. Only those enabling strategies beyond the entry level cutoff, strategies that will become part of the instruction, need be translated into instructional objectives. During the process of drafting objectives you must again consider needs, goals, constraints and learner characteristics and the medium as these will affect how the objective's components are written.

An instructional objective is a statement comprised of four elements:

WHO
DOES WHAT
UNDER WHAT CONDITIONS
WITH WHAT EFFECT

For the simple vocabulary example in which five concrete nouns are to be learned, the objective might be:

The learner--WHO
will correctly match the five vocabulary items to their corresponding pictures--DOES WHAT
by clicking the mouse on the correct picture when presented a word and a choice of pictures--UNDER
WHAT CONDITIONS (MEDIUM DEPENDENT)
and will receive positive feedback for the correct response--WITH WHAT EFFECT (MEDIUM
DEPENDENT)

In an objective the learner, as defined during the needs analysis and description of learner characteristics phases, is the first component of the statement. The desired outcome of the instructional sequence is then included in the form of a verb, an action that the learner will perform which will indicate mastery of an enabling strategy or, in this case, the terminal competency. The verb match has been chosen for this illustration.

As a set of limited, well-defined components, the objective also serves as a system whereby you can initially draft actual learner system interactions. It is appropriate, therefore, to list possibilities for the DOES WHAT, UNDER WHAT CONDITIONS and WITH WHAT EFFECT that come to mind while constructing objectives. In the example above, a number of assumptions have been arbitrarily made for the purpose of illustration. The temporary nature of the medium-dependent components of the objective is entirely in order as you have not yet explored all possible forms of student-system interaction and media selection. Selection of on-line interaction strategies can later be narrowed down and refined.

The understanding and responding to requests example is clearly more involved than the simple vocabulary analysis in terms of enabling strategies. For larger language competencies, then, writing objectives and tentative instructional strategies must consider the integration of multiple and varied enabling strategies. In terms of

chunking content and corresponding instructional strategies for the larger Request competency, these can be 1) presumed 2) made into separate instructional units or 3) merged into a single activity.

Again, the flexible nature of these preliminary written objectives needs to be stressed. Exploring possibilities for the Request competency (writing objectives for the possible treatments of the competency's components) is a valuable, instructive process for as the more varied a set of treatments, the more flexibility when you later explore methods of orchestrating student-system interaction.

For example--

OBJECTIVE: student will correctly respond to aural requests

- by
- a. clicking the mouse on the appropriate object and action
 - b. matching an aural request to an action depicted
 - c. typing in missing words in text version of aural request

- given
- a. an aural request and symbols or pictures of these
 - b. four visual sequences of possible actions (responses to request)
 - c. an aural cue and the corresponding text with words deleted

- so that
- a. student will see result of his/her response to request
 - b. student selection will result in visual and aural feedback appropriate to that selection
 - c. student input will receive supportive or remedial feedback

It is useful to sketch out, as in the example above, "complete" alternative objectives by listing as many conditions and effects specific to an interactive video system as possible. Writing objectives, then, is a means of working through existing definitions and selected content to pinpoint desired learning outcomes. How learning outcomes will be affected, what instructional and media strategies will be integrated and employed, can be taken up more formally once content and related competencies are ordered and desired learning outcomes are determined.

Review:

1. Select and organize content.
2. Analyze enabling strategies for selected competency.
3. Organize these enabling strategies hierarchically under the stated language competency.
4. Determine entry level (requisite strategies) for the CALL/IVD course unit.
5. Translate enabling strategies into instructional objectives, tentatively listing possible conditions and effects.

Phase III--Instructional Strategies

Draft System-Learner Dialogs: Selection of content and the subsequent analyses are mentally demanding tasks but are certainly necessary prerequisites to assembling the larger instructional experience. This next phase is clearly the most exciting and creative as, now that you have performed the preliminary analyses and defined content and outcomes (however loosely), you can explore student-system interaction possibilities using the powerful IVD medium. Note that designing interaction can be a very unexciting and frustrating experience if the preceding front-end analyses have not been performed or if all issues have not been carefully thought out.

Though constant review and revision is a requirement of a systems approach, it is especially instructive to return to and recheck these statements and definitions before tackling the actual design of learner-system interaction, what the instruction will actually look like. What the target learner needs and which the institution is not providing, what the overall goal of the CALL/IVD instruction constitutes, the identified constraints for delivering the materials and specific learner characteristics will contribute to the thinking and development of this dialog-writing.

This interaction between the student or students and the system is what promotes useful practice in and acquisition of the stated competencies. It is your role as designer to orchestrate this interchange in light of predetermined statements, definitions and analyses.

Three types of interaction, three human-system configurations: single user, pair work and group work are here described and design considerations pertinent to each discussed.

1) Single User Dialogs: The design of the dialog is clearly affected by the number of participants in the on-line learning sessions. Individual student IV workstations may be in order if prior definitions and analyses lead to the conclusion that given specific learners, learning environment, needs, goals, constraints, enabling strategies and desired outcomes (objectives) that this is the most effective configuration. Given the system attribute "self paced instruction", it is very often the single user set up which is the conversation of choice for much instructional software.

Essentially the writing of learner-system dialogs involves predicting what responses students will have in response to the system's cues and responses as is represented in Figure 3.

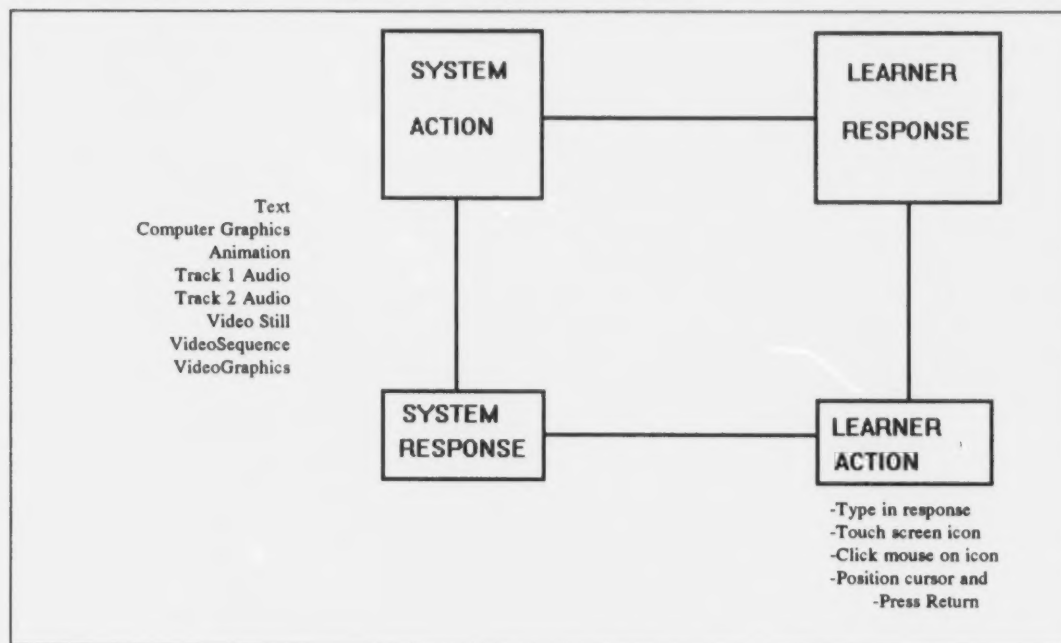


Figure 3

Returning to the simple five vocabulary item example, we can consider specific actions and responses within the learner-system dialog in Figure 3. We can build up to the vocabulary competency by returning to the analysis of enabling strategies and assessing the entry level strategies or skills assumed or at what point the instructional dialog should commence. For this competency a prerequisite becomes the presentation of the targeted vocabulary items. Using running video with native speaker audio and the targeted vocabulary items in text form to present the concrete nouns in an engaging, meaningful context presents one approach. Given this system action (video

plus audio), how, therefore, could a dialog be orchestrated in which the learner can participate during such a presentation? What might motivate a single learner and engage her in such a presentation?

Reviewing the tentative medium-dependent elements of the objective for the terminal competency, we see that the medium-dependent portions of the objective are: "...by clicking the mouse on the correct picture when presented a word and a choice of pictures" (UNDER WHAT CONDITIONS) and "will receive positive feedback for the correct response" (WITH WHAT EFFECT). From these two portions of the drafted objective we can see how one possibility for a single user-system dialog emerges. In other words, from carefully thinking through and drafting specific objectives from an analysis of enabling strategies, methods of orchestrating the learner-system interaction become readily apparent.

Using the same media combination as the presentation portion of the vocabulary module (video, audio and text) the student can effectively match the targeted items "by clicking the mouse on the correct picture when presented a word (orally and in text form) and a choice of pictures and receive positive feedback for the correct response".

For the more involved "Respond to Requests" example discussed earlier, recall that a number of possible treatments were listed during the objectives writing stage for the terminal competency. With the end competency being "...respond to verbal requests in English", the alternative medium-dependent portions of the objective can now be explored in terms of initiating and maintaining to best advantage the learner-system dialog.

OBJECTIVE: student will correctly respond to aural requests

- | | |
|---------|---|
| by | <ul style="list-style-type: none"> a. clicking the mouse on the appropriate object and action b. matching an aural request to an action depicted c. typing in missing words in text version of aural request |
| given | <ul style="list-style-type: none"> a. an aural request and symbols or pictures of these b. four visual sequences of possible actions (responses to request) c. an aural cue and the corresponding text with words deleted |
| so that | <ul style="list-style-type: none"> a. student will see result of his/her response to request b. student selection will result in visual and aural feedback appropriate to that selection c. student input will receive supportive or remedial feedback |

You can match both actions and responses on the part of the system to specific media combinations. Conditions and effects coupled with the nature of the language competency in question may point to the integration of running video, audio, graphics and possibly animation for the "Respond to Requests" example. Exploring possible combination of conditions, effects and media combinations by plugging these into the learner-system dialog model is, then, one systematic method of determining what the interaction of the learner with the system will look like.

2) Competitive Pair Work: Clearly CALL/IVD courseware designed for the single user plus system configuration can also be used by pairs of language learners. In the case of pair work, responses to the system action would need to be discussed and negotiated and some agreement between the two partners reached. In this case the design can either be the single student-system model or the one for group work which follows.

If, however, it has been determined through the analyses of needs, goals, constraints, learner characteristics and content selected that the element of competition in the CALL/IVD materials would be beneficial, then a very different type of system-user dialog or pattern of interaction is required.

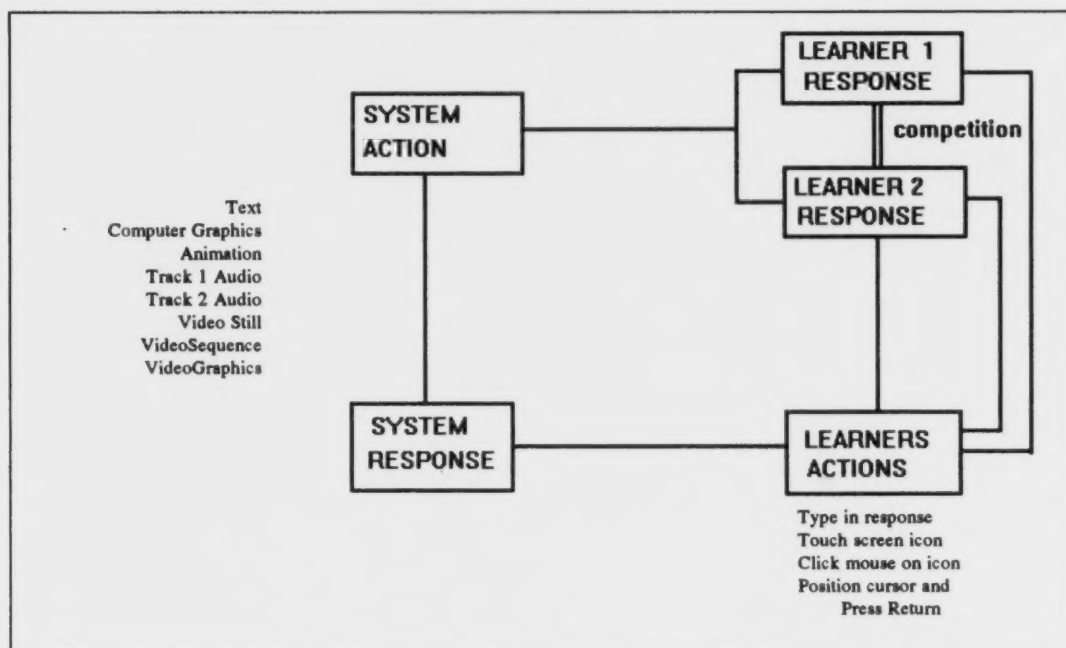


Figure 4

In order for students to compete, the system's actions can either require that the two students take turns responding to try for the higher score for correct responses, or compete against each other in time. That is, the faster learner "wins".

3) Group Work: If it has been determined through prior analyses that a single system in the classroom is desirable and/or it is clear that funding and available interactive video systems are limited to one per class, materials must clearly be designed accordingly. This means that group exploration and decision making in respond to system actions with a collective learner (or teacher) action is in order.

Software designers with Tom Snyder Productions have a unique approach to orchestrating large group or whole class learning centered around a single computer. Rather than focus on generating a dialog between the system and the user, these designers begin by thinking about what conversations between and among students would ideally look like. Student-to-student interaction while solving problems posed by the system, then, becomes the focus of Snyder software (Snyder, 1985).

Such a technique has immediate implications for language instruction as student to student interaction is often a primary goal of language class activities. What students should ideally be discussing, how they should be using language to interact, can then become the basis of designing system actions and responses as the means of prompting and guiding such exchanges.

As the focus of a group or whole class activity, the IV system can introduce students to and engage them in a situation or "simulated environment" and call upon them to play specific roles in, for example, solving a problem and/or achieving a goal. Group decisions then determine the system's responses and steer the course of the activity. For an excellent example of software designed to orchestrate this kind of group involvement, see the "Decisions, Decisions" series by Tom Snyder Productions.

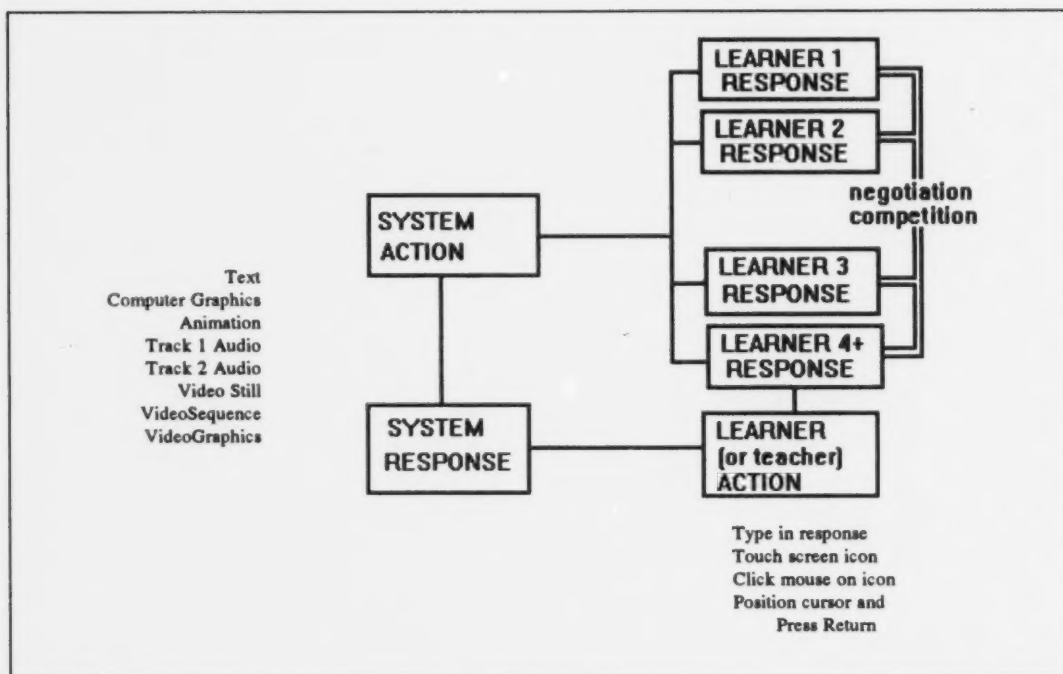


Figure 5

In sum, the conversation or dynamic that grows out of matching the conditions and effects portions of the written objectives to specifications and responses on the part of the learner(s) and the system is the basis of effective CALL/IVD instructional materials. Once you have a fairly good notion of what that conversation should look like and some idea of the best media combinations to employ to affect such conversations, you can prepare the design documents necessary for you to communicate the instructional plan to others.

Design Documents

1) Course Outline: Once forms of learner-system interaction which compliment established content and objectives have been thoroughly explored, these must be translated into a working outline of the proposed CALL/IVD course. The most constructive format for this outline is a simple narrative of what the learner-system conversation will look like, i.e.: "The learner is told by the lesson Guide (a video talking head) that she is about to observe how a boss and employee typically work together in an office. She is also told that she can stop the action, access the text to the spoken dialog, replay and portion or ask for help at any time. The learner is given two options: 1) Repeat the introduction and 2) See the office video. If the learner chooses to repeat the introduction, the system will replay the last sequence. If the learner chooses to see the office video, a video sequence showing a boss and a secretary working together will be shown. The boss will be requesting that the secretary....", etc.

The purpose of this narrative outline is to 1) help you to formulate and clarify your own thinking in terms of what the final instruction will look like and 2) allow others involved in the CALL/IVD project to understand your intentions as a designer.

2) Project Specifications: All previously developed statements, definitions and analyses and the proposed course outline make up the Project Specifications Package. This is the key document upon which subsequent development will be based. The production and implementation of a videodisc project requires the participation and expertise of video and computer specialists. Such a project demands that goals and requirements be clearly

communicated to these specialists along with administrators, those providing funding and other colleagues. This document, then, serves to lay out your instructional plan for others to understand and respond to. Clearly written project specifications then will help you to establish a common language and point of departure with others participating in and contributing to the project.

The following is an outline of the components of the project specification document:

- I. Project Overview
 - A. Statement of Need
 - B. Statement of Goals
 - C. Determination of Constraints
 - D. Description of the Target Learner
- II. Course Outline
 - A. Content
 - B. Objectives
 - C. Course Narrative

3) Production Sheets: In addition to the narrative of the outlined course, the designer must produce design documents or worksheets on which the narrative is translated into specific instructional events. These are the working documents from which both the video producer and the computer specialist will work directly. They are the vehicle by which the designer communicates what she envisions the learner-system interaction to look like. Production sheets (Figure 6) are also called "storyboards" as they depict the story or series of actions which affect the stated learning outcomes.

LESSON _____	PRODUCTION SHEET NO. _____
ESTIMATED TIME (SECS.) _____	
GRAPHICS VIDEO _____ STILL _____ MOTION _____ TO _____	
TEXT:	
VIDEODISC FRAME NO. _____ AUDIO 1: AUDIO 2: STOP PAUSE BRANCHING:	

Figure 6

The page number of the production sheet is to be written in the space in the upper right corner of the sheet. Production sheets should be numbered by fives so that you can later insert sheets which you forgot or which hadn't yet been formalized using page numbers two, three, four, for example. Page numbers are particularly important for, like the design process itself which requires constant backtracking and revision, working on production sheet numbers 15 and 115 can be interdependent processes.

The lesson name on every production sheet (upper left) will help to identify particular lessons, units or modules. Estimating the length of the instructional event (3-5 seconds for a menu decision versus 40-50 seconds of interacting with a sequence of running video) is helpful as it indicates at a glance the "depth" or degree of interaction the event allows.

Media options (graphics, text, still video, motion video) can be circled or checked depending upon selection of media combinations for the learning event represented by the individual sheet. A space is included in which to write down video start and stop frame numbers when they become available or, in the case of repurposing, when desired sequences have been logged from of the videodisc's frame numbers.

The large box in the center of the page represents the computer/video screen, the display through which students will interact with the system. Sketches of video, graphics and text - what the screen will look like to the student - go here. Note that you will eventually need input from the computer specialist, video producer and, ideally, a screen design artist when shaping the final display. Finally, at the bottom of the production sheet are spaces in which transcriptions or scripts of audio can be written in. In the case of a repurposing project, the first three words and the last three words of the existing sequence will suffice. In the case of an original production, full "scripts" (to be recorded) should be written here.

You can use the space to the right of the storyboard to write in branching information for the computer programmer. This information should tell the computer programmer:

- where to branch to - what page or event will follow,
- the conditions for a branch,
- feedback for student input. (if this is to happen as part of the same page or event),
- timing. (if, for example, the designer wishes a delay of some kind between a student action and a system action)

The computer specialist will be responsible for the technical integration of media elements and the interaction strategies you have chosen to employ in your design. The production sheet is the key document by which you communicate the instructional plan to the programmer. Conferring with the programmer at production sheet stage will therefore:

- communicate specifics of the design to the programmer,
- help to customize and standardize the document to maximize the efficiency of implementation,
- inform the designer of what can and cannot be done technically so that changes can be made accordingly.

The production sheet is also an important document for the video producer for the project. Work through the production sheets with the video producer early in the project to ensure that what needs to be communicated in terms of production is clear. The video producer, like the computer specialist, should be familiar with background and project concepts from having read and discussed the project specifications with you. The video producer's role is to then translate the events described by the production sheets into appropriate video and audio sequences. Using the production sheets, the video producer will ultimately write a script for you to review and check against your design.

4) Course Map: Because the issue of branching is a complex one, it is advisable that a course map of some kind be sketched out in conjunction with designing the production sheets. It is useful to work out a map of the course (a "flowchart") by condensing events described in detail on the production sheets onto index cards and laying these out in relational fashion and/or working with the computer programmer who can rough out a map he or she finds the most efficient.

Evaluation Of Development Resources: The more fixed your notion of what is to be accomplished, the better the chances are for one to ultimately meet your goals. Evaluating needed resources, then, is best done when a firm concept and corresponding documents to communicate that concept are in place. Whether sufficient

funding is available to produce the video and do the computer programming required for these instruction strategies or whether lack of sufficient funding will later compromise the design can now be thoroughly addressed. More often than not poor management of funding and long term availability of personnel will jeopardize an interactive video project. It is vital, therefore, that the design for the CALL/IVD instruction be in place well in advance of budget planning. This includes, if possible, the acquisition of computer hardware, videodisc players, interface and software. If you are unclear as to what must be done to produce and implement the CALL/IVD materials, then funding issues cannot yet be treated with any degree of accuracy.

The three major budgetary considerations concern the purchase of hardware and software, the production of video sequences and the cost of programming the materials. As mentioned earlier, hardware and software purchase is contingent upon the capability to best to realize the project's design. Once production sheets have been worked through, distributors can be asked to demonstrate the features of their wares by actually implementing a piece of your design that you and your programmer have pinpointed as possibly problematic.

The best source of a budget for the production of the project's video and audio sequences should come from an experienced video producer who can accurately project production costs. Budgeting for the computer specialist(s) is difficult. CALL/IVD projects are very demanding in terms of programming time. Redesigning (reprogramming) once the materials have been field tested and evaluated is an additional expense. If at all possible, negotiate to pay your programmer(s) by the job, not by the hour. If this is not possible, ask the programmer(s) to project the number of hours needed to implement the paper design.

Implementation And Evaluation: Once the video producer and the computer specialist have begun to work on their respective tasks, the role of the instructional designer becomes that of evaluator. By working closely with both parties and by constantly seeking feedback from various parties concerning the design of the materials, the designer's task is to make sure that every aspect of implementation is carried out correctly.

One major requirement for well-designed instructional materials is formative evaluation and revision. It is, unfortunately, one of the most often overlooked phases of the process as it is time and labor intensive. However, thorough formative or "on-going" evaluation is what ensures that materials meet the instructional goals for such a project.

You can start to look for input and feedback as early on as with the course narrative. Language teachers are an obvious valuable source of the kind of feedback that will inform constructive changes and revisions of the material. Former students who have successfully or unsuccessfully studied the target language may also offer insight into the project's strengths and shortcomings. Having subject matter experts (teachers and former students) go through the production sheets (simulating the interaction to be implemented on the IVD system) is a very instructive process. Similar evaluations should be performed on the computer program itself (no video) prior to video production, on the raw footage of the video (no computer) prior to final editing, on the edited tape prior to disc mastering as well as on the final merged version.

The fact that you developed the learner-system interaction based on carefully defined objectives makes the evaluation of learning outcomes fairly straightforward. Outcomes have been defined in such a way as to be immediately measurable either on line or off. It is simply a matter of reviewing the course objectives and in turn either tracking students' performance on-line or writing test items off-line that match the DOES WHAT portions of the course objectives.

Your closeness to the project can clearly act as a barrier to objectivity after so much time and energy has been invested in it. The same can hold true for the video producer and the computer programmer. It is often surprising to find out from others not attached to the project just how much has been overlooked or confused. Cost in terms of time, energy and dollars clearly makes on-going evaluation by colleagues and students an absolute must.

Conclusion

Handling the many pieces of the CALL/IVD design puzzle is not a simple task. Each piece must be carefully molded and shaped to make up the larger picture that ultimately affects how the student will interact with the

target language in order to learn. The intent of this chapter has been to outline and describe one systematic approach to thinking about and organizing the process' requisite components that can streamline the process of designing interactive videodisc courseware for language instruction.

References

- DeBloois, M., Maki, K. & Hall, A. (1984). *Effectiveness of Interactive Videodisc Training: A Comprehensive Review*. The Monitor Report Series: Future Systems, Inc..
- Dick, W. & Carey, L. (1978). *A Systematic Approach to the Design of Instruction*. Dallas: Scott, Foresman and Company.
- Kemp, J. (1985). *The Instructional Design Process*. New York: Harper and Row.
- Meskill, C. (1986). *Movie Plus Micro: A Linguistic/Cultural Database*. Paper presented at the TESOL Conference, Anaheim, CA.
- Meskill, C. (1988). *The Exploratory Mode in Computer Assisted Language Learning: A Study of an Application for Students of English as a Second Language Using the Interactive Video Medium*. Unpublished doctoral dissertation, Boston University.
- Snyder, T. (1985). *Designing Interactive Courseware*, Presentation at the Harvard Graduate School in Education.
- WICAT Systems. (1982). *Interactive Videodisc: Design and Production*. Orem, UT. WICAT Systems.

Interactive Videodisc as Hypermedia¹

John Underwood
Western Washington University

Introduction: Hypermedia

Cris, a freshman student at a large, modern university, is seated at a workstation in what used to be called the "language lab." Several things have changed, though. In front of her is a color screen on which appear computer graphics and text superimposed on video images, all of which Cris controls by the simple click of a mouse. When the computer asks her questions about the content of the video story, she answers by typing in a short sentence in her best Spanish--to which the computer responds in the same way. And the stereo earphones she wears receive the dialogue and music of the video program as well as the digitized voice and sound effects of the computer.

As the language lab has changed, so too have the terms that identify it. Yesterday's "audio lab" has become (or is becoming) today's "hypermedia lab" or "multimedia center." Even a term like multimedia can be misleading, though. In the early '90's a multimedia center is no longer a place where one can go to use or borrow a variety of audio-visual devices (slide projectors, overhead projectors, cassette players, etc.). Nor does it mean, as it occasionally has, a modernized library with access to a variety of both book and non-book media. As used today, in the age of videodisc and the microcomputer, multimedia normally means "interactive multimedia," making it synonymous with hypermedia (see below). With slight differences of emphasis, all three terms denote the incorporation of a variety of media (such as video, audio, graphics, text, and animation) in a single computer-driven system, enabling users to "browse through, annotate, link, and elaborate on information in a rich, nonlinear, multimedia data base" (Ambron, 1987). Such systems are interactive in the sense that they elicit an exchange of information with the user--choices and decisions which lead to a self-designed route through the knowledge, allowing the user to spend as much or as little time on any particular point as is desired, to sense at all times that it is the user (and not the computer) who is in control of what is taking place, and hence to gain the fullest access possible to the information at hand.

To understand better this new form of learning and its place in education, we must go back to the printed word. Only one hundred fifty years ago, recorded information meant text (or drawing) on paper--simple, flat, and easy to grasp. Going to school meant mostly learning how to manage text. The transformation away from text began with radio and the telephone. And just as radio brought the sounds of life "out there" into the humblest and most isolated home, television brought the power of the visual image, "the world in a box." Today we're surrounded, even overwhelmed, by information in a multitude of electronic forms. In the same second that a television studio in New York down-links a live satellite news feed from Berlin, one can fax a photograph to Paris or send an electronic transfer of funds to Tokyo--all while being blissfully unaware of the technical apparatus that drives it. As the world becomes one big electronic network, some claim, the flow of information will become increasingly multisensory and multicultural, a kind of international hypermedia teleconferencing (Wilson, 1989).

Education tends to lag behind socio-technological change at a safe distance. Yet as language teachers we face the realization that the transmission of information (i. e., communication) is the very essence of our business, and that we are compelled to find a way to present and manage all this information in a coherent manner. As in the Age of Radio, dominated by one-way sound, the language profession went through its own Age of the Audio Lab,

¹Portions of this article have been published previously as Underwood, J. (1989). Hypermedia and Language Learning, *CALICO* 6, 3, 7-20.

only to discover that talking to a deaf machine was not all that helpful. Later it was the Age of (Educational) Film and then the Age of (Educational) Television, each somehow disappointing because neither could be manipulated--by the teacher, let alone by the student--in a way that would make the content more accessible. The Age of the Microcomputer promised to change all that. Computer-aided instruction was a truly interactive medium, with the student controlling the computer, going at her own pace, seeking her own path through the information. Or was it? The computer, too, turned out to be surprisingly limited, at least in most of the uses that language teachers could find for it. Much of computerized language practice has meant simply text on the screen, passages to be read screen by screen or questions to be answered. Even with the addition of simple graphics and accompanying "beep-beep" sounds, there was obviously not much going on, certainly very little that could be called "interaction." It was clear that we--and our students--needed more.

Hypertext and Hypermedia

There were those who had a different way of looking at computers in education. Nearly twenty years before the first Apple, a computer educator and experimenter by the name of Theodor Nelson (1960) had prophesied the manner in which the computer would change the very shape of the learning process. Included in the systems he envisioned was something called "hypertext." Unlike sequential or linear reading, including the mostly static on-screen text just described, his system would allow text to be linked interactively to other text or ideas in a non-sequential and multi-layered (hence "hyper-") fashion, whether the linked text was hidden on the same screen or stored in a dictionary file somewhere. Of course nonsequential reading in itself is hardly new; consider the way we use a phone book, a dictionary or even a newspaper, for example. But Nelson was on to something else. Years before anyone spoke of mouseclicks or touchscreens, he described how students would point at sentences on the screen and cause them to pop open to reveal an edited version of the same sentence, an annotation, or an encyclopedia entry. Still during the early 1960s, we find computer pioneer Doug Englebart experimenting with hypertext systems in his lab at the Stanford Research Institute (Ambron, 1987). To put this into historical perspective, it would still be at least twenty years until the first Macintosh and the first widespread use of the mouse for pointing and clicking.

Hypertext, then, is the means to manipulate on-screen text interactively. The structure of this textual information can be likened to layers of onion skin: underlying each layer is another; which layer gets read and which does not will depend on the needs of the user. A *hypermedia* system, in turn, adds different kinds of layers to this strictly textual environment. With the computer at the center, the hypermedia system may link several types of audio, still or motion video, graphics (including animated graphics) to the basic text on the screen. An interactive video system is one example of hypermedia, with the basically textual medium of the computer linked to, and controlling, the random access video and audio of the videodisc player. For example, while reading one of John Kennedy's speeches on the screen, the student might have the option of clicking on a sound button to hear it as Kennedy originally gave it, or a video button to view the corresponding segment of motion video from a laserdisc. Hypermedia is nothing less than a new way of handling information, and it makes new cognitive demands on us as users. For one thing, it forces us to reconsider our notion of "the text" and of reading itself. How does one "read" a source of information which can be approached from so many different directions, with so many different kinds of "text"? Perhaps only in the same way that one can "read" something as complex as a Gothic cathedral: by exploring--going back and forth, trying different angles, poking here and there, until one gradually gets a sense of what it means in a personal way.

Hypermedia likewise compels us to redefine what it means to be "interactive." The traditional classroom sense of interacting emphasizes the role of the student in both "conveying and receiving authentic messages (that is, messages which contain information of interest to the speaker and listener in a situation of importance to both)" (Rivers, 1989). In an interactive video system, interaction takes on a different meaning. For the time being, at least, student production is largely replaced by student control. The student is in charge, controlling the flow of information, determining her own pathway through the material, at her own pace. Different user choices will produce different outcomes, so that not even the same user is likely to experience the same interaction twice. Interaction is thus highly individual in nature, reflecting different user needs, different levels, different goals.

Hypermedia Tools: HyperCard

Although interactive video systems for language learning have been around since *Montevidisco* (Gale, 1983) they only became feasible on a large scale in the summer of 1987 with the introduction of HyperCard, Apple Computer's "personal information management system", quickly recognized by educational materials developers as a truly general-purpose hypermedia authoring system. There are now several other (and there undoubtedly will be more), authoring systems of this type,² yet it seems fair to regard HyperCard as a sort of archetype--partly because it was the first of its kind, partly due to Apple's marketing strategy of bundling the program free with each new Macintosh, and because--as a result of this strategy--there are now well over a million copies of the software in use. Hence in the following discussion of the use of HyperCard in developing a hypermedia system, references to the workings of this particular application may be taken generically, as referring to the entire class.

An authoring system is a level above authoring languages such as SuperPILOT, which generally require the mastery of a relatively cryptic code and a quasi-mathematical way of describing things in order to make them work. Most authoring systems are designed so that the teacher/author does not have to confront the code at all, but need only think about the content of the program--what it should say and where it should say it. The programming goes on behind the scenes, so to speak. What authors see is a set of "tools" to make their job easier: screen management tools, drawing tools and "clip art," text layout tools and special tools for controlling peripheral devices such as videodisc players and CD-ROM players.

Most of the hypermedia power of HyperCard lies in its "button tool." A HyperCard "button" is a spot on the screen that the user clicks on with the mouse in order to cause something to happen--to go to another screen, get more information, cause text fields to appear or disappear, or control a video device. A button, like the onion skin of hypertext, has unseen layers underneath, containing information which is important to HyperCard but which may or may not be of interest to the author. This information is the button's "script," a mini-program generated by the system in an English-like language known as HyperTalk. The author may well decide to ignore the script and use the button tool in the same way most of us use a word-processing program--without asking how it works. On the other hand, learning its idiom and coming to grips with its logic opens up another world of possibilities. These range from the trivial, such as adding visual effects to buttons ("dissolve", "wipe left", "barn door open", etc.), to the essential, such as showing or hiding a piece of text. In an interactive video program, a button designed to play a particular segment of motion video, say from frame 1200 to 1450, might have a behind-the-scenes script something like this ("mouseUp" merely reminds us, and the computer, that this will take place as soon as we let go of the mouse button):

```
on mouseUp
  playVideo 1200,1450
end mouseUp
```

Most other commands are equally transparent, although the syntax may be somewhat inelegant at times. A button intended to display a text field named "menu" on which we have typed a list of click-on choices might carry no more script (between "mouseUps," that is) than this terse message:

```
show menu
```

A button which will take us from the card where we are presently reading about (and perhaps watching a video clip of) Barcelona, to a card in another "stack" of cards containing a map of Barcelona, might contain this script:

```
visual effect iris open
go to card Barcelona of stack Maps
```

²For the Macintosh: AuthorWare's Course of ActionTM, Macromind's Macromind DirectorTM, Owl International's GuideTM, and EastGate System's HyperGateTM; for the IBM InfoWindowTM: LinkWayTM, Duke University's CALIS; for the Amiga: AmigaVisionTM.

This script assumes there is a "stack" of related cards (somewhat like a file) named "Maps," and that one of these cards has been named "Barcelona." The added visual effect makes the transition between the two cards (screens) more dramatic and reminds users that they are leaving their present location; "iris open" means the first card will open up like a camera lens to reveal the other.

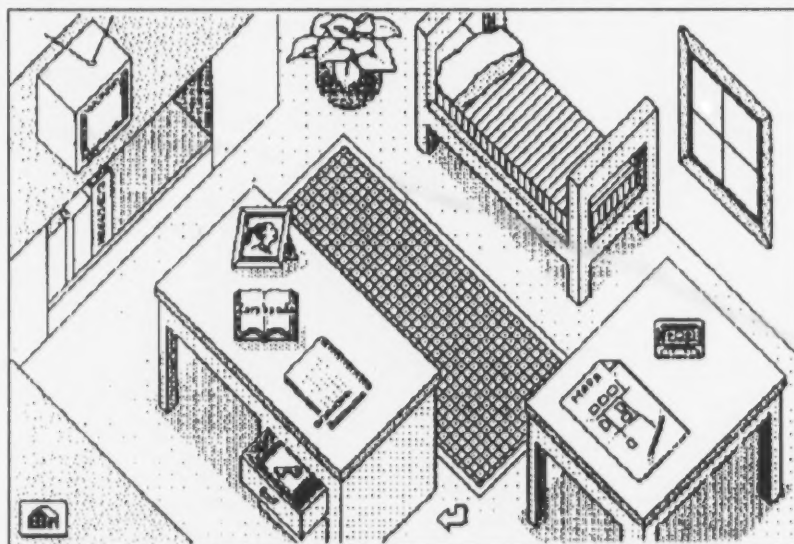
A Hypermedia Prototype: *The Zarabanda Notebook*

The author has described elsewhere an experimental hypermedia program developed with HyperCard and a videodisc player (Underwood, 1989). What follows is an update, describing elements which have been incorporated into what has turned out to be an ongoing experiment in hypermedia design. The program is intended to serve as a notebook to accompany the videodisc version of *Zarabanda*, 25-episode soap opera produced in 1973 by the British Broadcasting Corporation for the teaching of Spanish (*Zarabanda*, 1973). The story centers on the exploits of Ramiro, a young mechanic from a small village in Spain who goes to the city to seek his fortune. The series was filmed on location in Spain with native actors, and contains a wealth of linguistic and cultural information, although it is admittedly somewhat dated in places.

Accessibility is the goal behind the *Notebook*. It was designed on the assumption that while the classroom teacher might tend to show an episode more or less from top to bottom, stopping occasionally to ask questions or make comments, students should be given tools for manipulating the material by themselves (or in small groups) at a language lab workstation. This is not to disparage the use of video in the classroom as a source of straightforward language input; assuming the material is at the appropriate level, is interesting and motivating, and is suitably introduced and annotated by the teacher, video may well be one of our best classroom resources. What "repurposed" video such as the *Notebook* offers is a way for students working alone to come to grips with everything they see and hear--both at the linguistic level and at the story level.

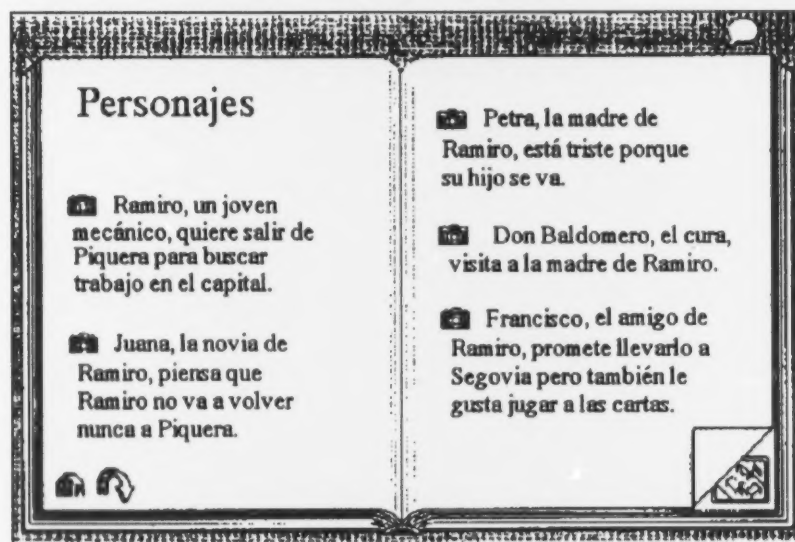
Comprehension of *Zarabanda* is facilitated through several interactive guidebook-type features. In this prototype, which covers only the first episode, these are as follows:

Ramiro's Room. The graphic depiction of our hero's room (Figure 1), and the objects in it, serves as a metaphor for the central action of the first episode (his leaving home) and as a sort of mnemonic home base/main menu for the user, a place to which one can always return in order to choose the next move. The various objects in the room are all buttons, each an icon of the different elements in the program which can be explored:



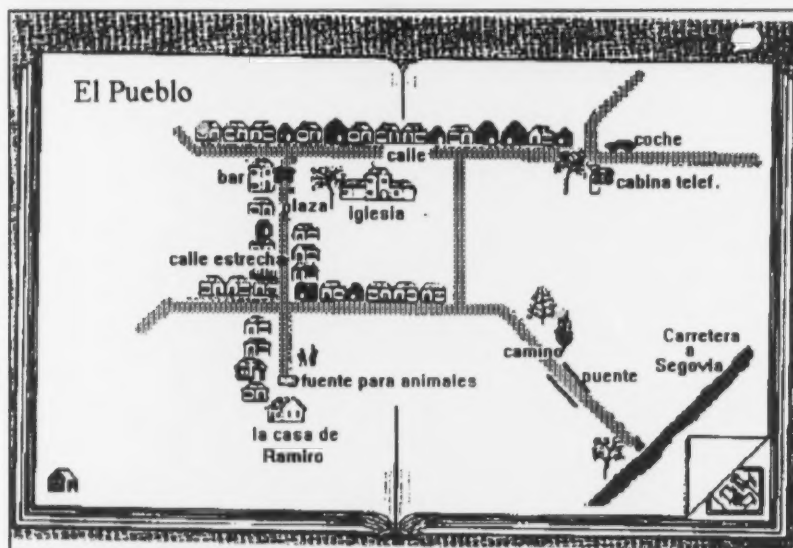
[Figure 1. *Zarabanda Notebook* Ramiro's Room.]

Clicking on the book icon, for example, takes the student to an introductory video clip which sets the scene for the whole series by showing (and describing in voiceover) life in Ramiro's village; the color images on the video screen are accompanied on the Macintosh screen by the Spanish transcript of the voiceover. Choosing the portrait of Ramiro's girlfriend brings up a brief presentation of the cast of characters for the first episode (Figure 2):



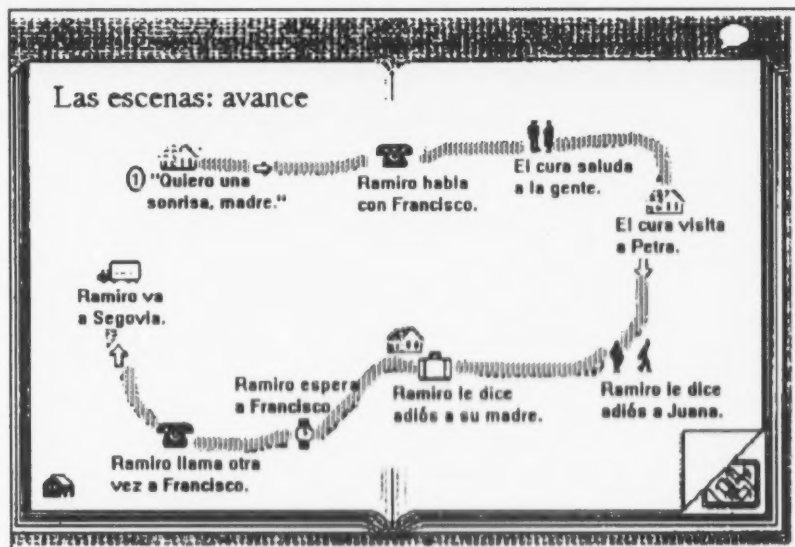
[Figure 2. *Zarabanda Notebook* Cast of Characters for Episode One.]

Clicking on each camera icon causes the videodisc player to jump to a "snapshot," a freeze-frame closeup of the character described on the Mac screen. The map icon takes the student to a computergraphic map of the village (Figure 3); when the student clicks on any of the labeled features, the videodisc player displays a still-frame picture of that part of the village:



[Figure 3. *Zarabanda Notebook* Map of the Village.]

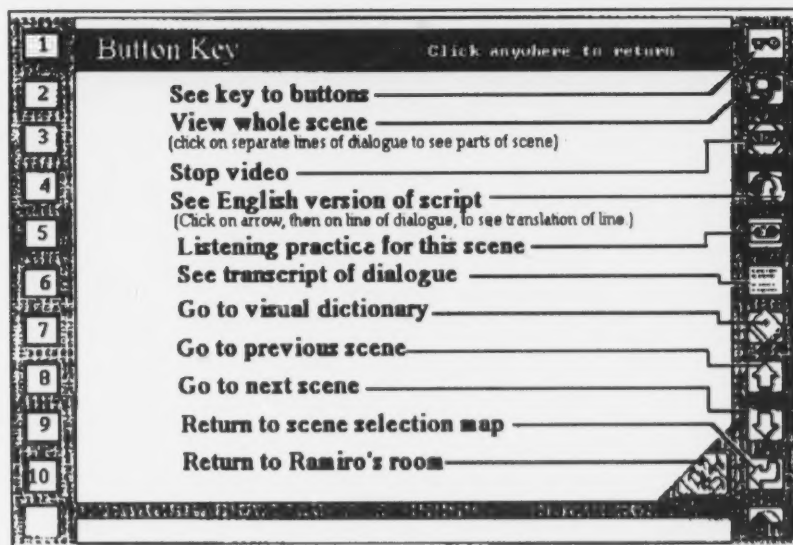
The television icon offers students a choice between seeing a preview of the video scenes or viewing the full scenes. Choosing the preview takes them to a "story map," a spatial representation of the sequence of scenes in the first episode, starting with the first scene in the upper left and ending with the last scene in the lower left (Figure 4):



[Figure 4. *Zarabanda Notebook* Story Map for Episode One.]

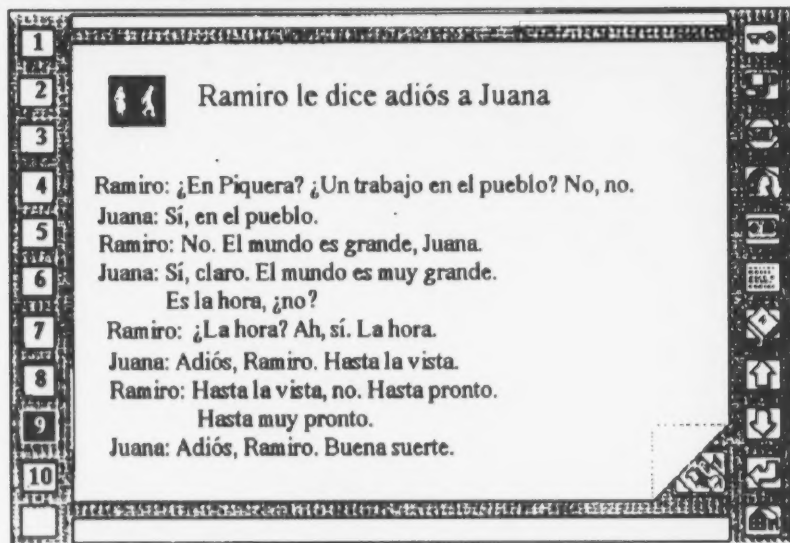
This map is a good example of the layering of different media in a hypermedia system. On one level, the map is a two-dimensional drawing designed to help the student visualize the flow of the scenes, to see time in terms of space. On a different level, the map is alive: each of the flat icons representing the scenes is also a button containing a videodisc command. Clicking on a scene icon plays a ten-second preview of the scene, featuring a key line of dialogue and an important visual suggestion of the action at that point. By clicking on all thirteen icons in succession, the student gets a strong sense of the movement of the story through the episode, and is in a position to make reliable predictions about what is going to happen. Such predictions constitute a kind of "pre-reading" or "previewing" activity—one more way to reach a fuller understanding of the material.

Viewing the Scenes. Following this preview (or perhaps preceding it, since the order depends on the student), one can ask to see a full scene. This takes the viewer to a different mode of the program, with a different set of control buttons. The function of the various controls is explained on the "button key" card (Figure 5):



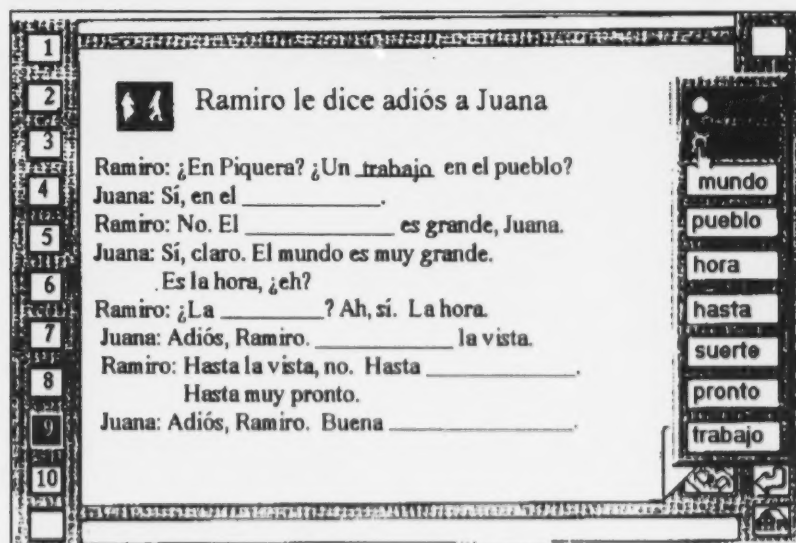
[Figure 5. *Zarabanda Notebook* Button Key for Scene Cards.]

The scene card (Figure 6) offers the student a chance to access the corresponding video in a variety of ways: by playing the full segment without the Spanish transcript, playing the segment with the transcript, playing single lines of dialogue by clicking on sentences in the script (each line is covered by a separate, invisible, button), or playing the same lines with the English translation of the sentence momentarily visible.



[Figure 6. *Zarabanda Notebook* Scene Card for Scene Nine.]

Hypermedia Exercises. The cassette-player button takes the student to a listening comprehension exercise consisting of a cloze-type activity based on the script of each scene (Figure 7).



[Figure 7. *Zarabanda Notebook* Listening Exercise for Scene Nine.]

Here the program turns off the video portion of the scene so that the student can concentrate on the sounds of the dialogue. While listening, the student clicks on one of the unordered words listed on the right. As long as the words are chosen in the correct sequence, they will appear one-by-one in the blanks in the dialogue until the student reaches the end. If a word is clicked on out of sequence, the student is admonished with a gong sound. If at any point students feel they cannot keep up with the dialogue, they need only click on "Stop," then restart at any point by clicking on the appropriate line of dialogue. Exercises of this type (and one can imagine any number of possible formats) are thus hypermedia activities in the sense that the computer instantly invokes other media in order to make the exercise more complete, more authentic--or simply more appealing.³

Conclusion: Hypermedia and the Student

Although it is still too early to have the results of any extensive studies of the pedagogical value of hypermedia,⁴ there are several aspects of videodisc-based hypermedia which would appear to be related to the acquisition of language in important ways. For one thing, hypermedia allows students to see, hear and read the language simultaneously. Not only is this a richer view of language, it is also a better reflection of the multidimensional nature of language use in real life, a point often missed by students when practicing isolated structural exercises, vocabulary drills, and the like. In addition to providing the authentic cultural and linguistic environment of video, hypermedia offers students ways of making this material more accessible to them, of converting mere input into a comprehensible (hence usable) form. Because there is always more than one way of approaching the material, the hypermedia system assures that each student will find something meaningful and useful to his or her own learning process. And as more is learned about the strategies of the learner in the language acquisition process, it seems increasingly important that all of these decisions and choices are the student's, that the student must be permitted to exercise his or her own judgment as to how to proceed. In the very act of negotiating for meaning--negotiating, in this case, through one's choice of instructions to the computer--students take control of the learning process and both develop and pursue their own learning strategies.

³Many educational videodiscs (including this one) contain a second audio track with different material from that on track one. The *Zarabanda* disc has oral grammar exercises, for example. Others feature a third-person narration of the dialogue, or a slower and more deliberately pronounced version of the original, allowing students to get help in understanding without consulting the transcript.

⁴See Doughty's article (p. 1 in this volume) for a description of expected research in this area.

References

- Ambron, S. (1987). Introduction--New Visions of Reality: Multimedia and Education. In Ambron, S, & Hooper, C. (Eds.), *Multimedia in Education* (p. 7). Cupertino, CA: Apple Computer, Inc.
- Gale, L. E. (1983). Montevidisco: An Anecdotal History of an Interactive Videodisc. *CALICO Journal*, 1.1: 41-46.
- Nelson, Theodor. (1960). *Computer Lib/Dream Machines* Chicago: Otto's Books.
- Rivers, Wilga. (1989). *Ten Principles of Interactive Language Learning*. NFLC Occasional Papers. Washington, D.C.: NFLC.
- Underwood, John. (1989). Hypermedia and Language Learning. *CALICO Journal*, 6.3, 7-20.
- Wilson, Kathleen. (1989) Through the Multimedia Looking Glass. *Apple Education News*, Spring 1989.
- Zarabanda 1973). Chicago, Ill: Films, Inc. (U.S. distributor).

Language Discovery Environments

A. Allen Rowe

Interactive Language Instruction and Development

ILIAD

Introduction

Applications of new technologies to old models of instruction tend to disrupt the latter, devitalize the former, and result in little or no improvement. For interactive video to effect significant improvements it must find its place in an appropriate model or paradigm of language study. This article introduces one such paradigm--Language Discovery Environments--and shows how this paradigm can contribute to successful interventions for interactive video and other technologies.

Influences

The work done by Michael Bush at the United States Air Force Academy in the late '70's was convincing evidence of the usefulness of computers in education. A project with Texas Instruments in 1980 offered a glimpse of interactive video. In 1980 and '81 came the decisive influence of "Montevidisco" provided by Adrian Van Monfranz, Junius Bennion, Larry Gale, Ed Schneider, and their colleagues at the McKay Institute at Brigham Young University. The Systems Approach to Training (SAT) encountered at the Defense Language Institute between 1982 and 1986 underscored the importance of systematically integrating media into an overall architecture of instruction. Stephen Krashen's 1982 book *Principles and Practice in Second Language Acquisition* provided a new way of thinking about the broad scope of language study.

Need For A New Paradigm

Seymour Papert's book *Mindstorms* (1980) offers a parable relating to the application of technology to education:

Imagine someone living in the nineteenth century who felt the need to improve methods of transportation. He was persuaded that the route to new methods started with a deep understanding of the existing problems. So he began a careful study of the differences among horse-drawn carriages. He carefully documented by the most refined methods how speed varied with the form and substance of various kinds of axles, bearings, and harnessing techniques.

In retrospect, we know that the road that led from nineteenth-century transportation was quite different. The invention of the automobile and the airplane did not come from a detailed study of how their predecessors, such as horse-drawn carriages, worked or did not work. Yet, this is the model for contemporary educational research. The standard paradigms for education research take the existing classroom or extracurricular culture as the primary object of study. (p. 44)

Borrowing from Papert's parable, one can think of interactive audio/video (IAV) interventions in most current programs of language instruction as applications of technology to improve the performance of horse-drawn carriages. In the present situation language teachers and students alike are hampered in their efforts by an old vehicle which can no longer keep up with the foreign language proficiency demands of an increasingly international world.

The Present Situation

The present situation can be summarized via a series of equations:

Proficiency (PRO) is the objective and is thought to be a function (f) of competency (COMP):

$$\text{PRO} = f(\text{COMP})$$

But competency is reached through acquisition (ACQ):

$$\text{COMP} = f(\text{ACQ})$$

And acquisition is not the same thing as learning:

$$\text{ACQ} < > \text{LNG}$$

Acquisition is a function of some unknown (x):

$$\text{ACQ} = f(x)$$

In the early 1980's Steven Krashen offered the theory that acquisition is a function of input (INP):

$$\text{ACQ} = f(\text{INP})$$

A decade of experimentation with this hypothesis suggests a refinement:

$$\text{ACQ} = f(\text{INP} + \text{OUTP}) + f(\text{UND}) + f(x')$$

In other words acquisition is a function of input and output(OUTP) and at the same time a function of a cognitive understanding (UND) of the language as well as a function of some yet unknown factor or factors (x').

But input plus output can be defined as communication(COMM). Thus:

$$\text{ACQ} = f(\text{COMM}) + f(\text{UND}) + f(x')$$

Language Teaching Environments

Currently the dominant paradigm for language learning is that of language teaching environments where it is assumed that both communication and understanding depend primarily on teaching (TCH):

$$\text{COMM} = f(\text{TCH}); \text{ and } \text{UND} = f(\text{TCH})$$

This gives:

$$\text{ACQ} = f(\text{TCH}) + f(x')$$

Given that x' is an unknown, the relationship under most teaching environments is assumed to be simply:

$$\text{ACQ} = f(\text{TCH})$$

When this equation fails to hold true, rather than question the validity of the assumption that both communication and understanding are functions of teaching, most often the nature of the teaching in question is assumed to be at fault. One then posits the solution:

$$\text{ACQ} = f(\text{TCH}') \text{ where } \text{TCH}' \text{ is a different approach to teaching.}$$

This assumption results in the ongoing search for better approaches to teaching. Or in terms of Papert's parable, the focus is on the nature of the old vehicle rather than on a significantly different means of locomotion.

Paradigm Shift

Perhaps a shift of paradigm is needed to provide an exit from the infinite loop of the TCH' equation. Thomas Kuhn writes in *The Structure of Scientific Revolution* (1970), "In the absence of a paradigm or some candidate for paradigm, all of the facts that could possibly pertain to the development of a given science are likely to seem equally relevant" (p. 15). The following candidate for paradigm is intended to help identify the most relevant

facts and issues pertaining to the science of foreign language IAV and the development of a better means of transportation to proficiency.

Language Discovery Environment Overview

One possible paradigmatic conceptual architecture for integrating advanced media with the evolution of second language acquisition theory is that of the Language Discovery Environment. This architecture is based on the hypothesis that the most efficient and cost effective environment for improving proficiency is one which stimulates discovery. This discovery comes through exploration and interaction involving a large sampling of the target language. The Discovery Environment paradigm consists of at least ten key components:

1. The Motivational Shell
2. Language Samples
3. The Exploration Vehicle
4. Linked References
5. Master Teacher Resources
6. Consolidation and Evaluation Activities
7. Phonology Tutoring
8. Peer Interaction
9. Applications
10. Learning Management

Any such list demands the application of Occam's razor: Does it respect the principles of parsimony and still include all necessary elements (*Knowledge Disc*, 1985: 36,205-36,206)? This can be more clearly determined by examining the fundamental design questions posed by each component.

The Motivational Shell: Student motivation is the single most important consideration in designing a Language Discovery Environment. The design of the motivational shell focuses on the student. This shell must motivate students to explore and discover the language and its associated cultures as personally implicated participants, not as external observers of alien phenomena. The shell must also sustain very high motivation all the way down to task-level activities. Failure to design motivation into every level of the program can result in rapid erosion of even the most positive attitude. The first design question is how to establish an overall positive attitude toward: 1) language study in a Discovery Environment and 2) the target language and cultures.

Language Samples: Language samples are the foundation of Discovery Environments and are measured in terms of quantity, content, and quality. Language Discovery Environments encourage acquisition through personal discovery of how the language functions as a coherent system. Discovery depends on exploration of a large sampling of the language.

Quantity: How much input is enough? Krashen indicates the need for "massive amounts" (1982, p. 183). Research is needed to determine how improvements in proficiency vary with the quantity of IAV input. Meanwhile one must assume that the Discovery Environment should provide as much IAV input as possible.

How is input to be measured? Only original language is to be counted. Pauses and repetition do not count, nor do the lengthy silent transitions between utterances common to film and video. One example of a misleading measurement of input quantity is found in the audio cassette component of a 180-hour intensive basic foreign

language course offered at a well-known establishment of language instruction. Although total run time exceeds ten hours, the tape set contains only about 96 minutes of original material. The remaining time is devoted to pauses and repetitions.

Content: What genres are most effective, e.g. movies and soap operas, songs, specially designed instructional materials, slice-of-life reports, interviews, news, documentaries, travel logs, etc.?

How does one handle the relatively high level of difficulty of all these genre in most authentic manifestations? By providing exploration tracks and helps at various levels, Discovery Environments can greatly extend the span of effectiveness of any given sample over a broad range of learners. Under these conditions effectiveness becomes largely a function of the extent to which a student finds the material motivational. Materials with an extended story line seem to be among the most motivational, all else being equal. Such materials tend to promote affective involvement in target language culture and society rather than leaving students as objective external observers of alien phenomena.

In the case of content-based language instruction, samples would of course be chosen from the domain of the subject are being studied.

Quality: Quality is a function of pedagogical and technological acceptability. For the sake of practicality and economy of resources, relative rather than absolute standards should be applied. Pedagogically any sample is acceptable if it equals or surpasses its alternatives, e.g. the type of input students would receive if there were no IAV materials. The technological quality of the IAV materials should meet or surpass the normal media expectations of the student population.

The Exploration Vehicle: Exploration is essential for discovery. The exploration vehicle is an IAV software program which provides rapid and accurate access to any utterance in the sample. The component utterances of a sample may be grouped and indexed according to language function, grammar, vocabulary, cultural focus, and pedagogical, thematic and dramatic unity, thus providing various paths of exploration through the same sample. The efficacy of the exploration vehicle is judged in terms of comfort, safety, focus, speed, range, and responsiveness:

Comfort: One of the primary goals of a Language Discovery Environment is to involve learners in extended periods of exploration and interaction with the target language samples. Comfort is therefore of great importance. Significant design factors include seating, temperature, air quality, noise level, and decor.

Safety: Users must be protected from excess levels of radiation emanating from monitors and other electronic apparatus as well as from the charged dust particles generated by such radiation.

Focus: The design and functioning of the exploration vehicle must be such as to promote user focus on content. The vehicle and its operation must not detract from this focus.

Speed: How fast can the vehicle transport the user from any utterance in one grouping to any utterance in another grouping? Worst-case and average speed depend on the speed of the computer, response time for the audio-video storage medium and the efficiency of the user interface.

Range: How broad a sub-set of the target language can the vehicle access without interruption? This depends primarily on the capacity of the audio-video storage medium.

Responsiveness: Will the vehicle allow the user to stop at any time, pause for as long as desired, accurately and rapidly repeat any utterance as often as desired, and rapidly and accurately move to any other utterance within the area under exploration?

Linked References: Linked references are options offered by the computer to help the student come to comprehension and grasp concepts. These options should be accessible from the Exploration Vehicle as well as from the other operational components of the Discovery Environment, i.e. Master Teacher Resources, Consolidation and Validation Activities, Phonology Tutoring, and Applications. The usefulness of Linked References depends on breadth, coverage, richness, and speed.

Breadth: How many different sorts of reference are offered: grammatical/syntactical; lexical; cultural; semantic, e.g. illustration, paraphrase or translation?

Coverage: Does each category of reference contain information on all salient elements of the language samples?

Richness: How rich in varied stimuli are the references? Do they use color, sound, graphics, animation, video, and dynamic manipulation of text to convey information?

Speed: What are the worst-case and average response times in reaction to a user's request for information?

Master Teacher Resources: Exploration and discovery rapidly reveal complex aspects of the target language. Students may need assistance in grasping the concepts and principles underlying the surface phenomena encountered in the samples. At such junctures they may call for intelligent tutoring from a pedagogical resource which incorporates the audio-visual persona of a master teacher with animation, graphics, additional video and dynamic color-coded manipulation of text. The voice and video image of a master teacher provides a personal dimension to the tutoring while dynamic computerized manipulation of symbols, colors, images, and sounds provides helps generally not feasible in the standard classroom. Using these multi-media aids, the master teacher engages students in either Socratic or didactic exchanges designed to lead to understanding of the target language as a coherent system. Master Teacher Resources help students structure and assimilate an accurate cognitive grasp of the language through intelligent tutoring. Usefulness of these resources can be measured in terms of adaptivity in addition to the factors which apply to Linked References--breadth, coverage, richness, and speed.

Adaptivity: Do students have options allowing them to adapt instructional presentations to their own needs, proficiency, knowledge, and personal learning style? Do presentations rest primarily on Socratic interaction rather than on one-sided didactics?

Consolidation And Evaluation: These activities serve three purposes, that is to: 1) allow students to determine if they have reached adequate comprehension of a language sample or some portion thereof; 2) test students' on comprehension of representative input and understanding of specific concepts relating to the target language; 3) evaluate the effectiveness of the Discovery Environment and its components based on data from a significant number of interactions. Consolidation and evaluation activities must exploit the media and comply to the canon of good design.

Media Exploitation: Do the instruments of consolidation and evaluation exploit the unique capabilities of the various media available within a Discovery Environment rather than following only the precedent of traditional testing? For example does a computerized Cloze test present blanks to students or rather exploit the dynamic and interactive potential of the computer by requiring students to first discover where a blank should be before filling it in? Are the rapid feed-back and interactive capabilities of the computer used to make testing a worthwhile learning experience? Do the instruments reflect the nature of the environment, e.g. do they include IAV stimuli?

Design Cannon: Do the instruments meet the requirements of good test design: reliability, validity, and practicality?

Phonology Tutoring: Phonology tutoring complements comprehensible input in preparing students for speaking. Phonology tutoring must be in context and practical. In phonology tutoring, students learn to hear, identify, and accurately reproduce the sounds of the target language, particularly those not commonly found in their mother tongue.

In Context: Are the phonology activities set in a context of meaningful language and situations?

Practical: Are the apparatus and programs required for phonology activities justifiable in terms of results and opportunity costs as compared to other possible activities within a Discovery Environment which might also contribute to phonological improvement?

Peer Interaction: Students cooperate in the exploration, discovery, and assimilation of the language. Diad, triad, and small group cooperation adds a highly productive dimension to the Discovery Environment. Feasibility and variety are important considerations.

Feasibility: Do the facilities--IAV work stations, chairs, tables, etc. favor peer interaction?

Variety: Are students encouraged to interact in various Discovery Environment activities and with groups of differing size and composition?

Applications: Applications provide the opportunity for production. Students use the language in simulations or real-life situations. They should be well timed and innovative.

Well Timed: Are production requirements presented as an opportunity consistent with the student's readiness or as an arbitrary and unavoidable requirement?

Innovative: Is the potential of IAV exploited to help prepare students for production? For example, students can be required to beat out the rhythms and hum the intonations of selected utterances as pre-speaking activities. The boundaries of the Discovery Environment can be expanded by contacts with native speakers in the local community as well as through correspondence and long-distance telephone calls.

Learning Management: Learning Management helps students realize their goals in the many faceted context of the Discovery Environment. Management should be personalized, timely, and comprehensive. Student interactions are monitored and incorporated into predictive algorithms for matching and adapting the resources of the environment to the needs of the student.

Personalized: Do students receive guidance which reflects their personal goals, interactions with the Discovery Environment, and rate of progress?

Timely: Is guidance based on the current situation offered regularly and available rapidly on request?

Comprehensive: Does guidance take into account all aspects of the Discovery Environment and how they may be used or adapted to help students meet their objectives as efficiently as possible?

Meta Considerations

Certain factors influence all Discovery Environment components. These are the role of the student, the role of the teacher, the student/teacher ratio, location, facilities, and time.

Role Of The Student: Another factor to define in the constellation of elements comprising the Environment is the role of the student. For discovery to occur the focus must be on the target language and culture as an integral system or set of integral systems (in the event the target language is spoken in several different societies). The student should always be wondering, "What are they saying? How can I understand them? How is this language working? How do gestures, facial expressions, and context fit in?" This approach is diametrically opposed to focus on self: "What do I want to say?" The student's valid appetite for self-expression should be fed from the earliest hours of language discovery, not however from the student's own socio-cultural and linguistic perspective but from that of the target language. Otherwise students will persist in their own concepts and point of view rather than learning to perceive and understand those of the target language and societies. Thus communication centered on the personal world of individual students should not be encouraged at the expense of communication dealing with the target culture and values.

Role Of The Teacher: The primary function of the teacher in a Discovery Environment is to help students effectively and efficiently use the resources at their disposal to reach their goals. Thus the teacher serves as a manager working with the students to orchestrate the components of the environment in support of goal achievement.

As to instruction, teachers should explain rather than teach. Teaching is driven by the teacher's agenda; explanation is in response to a student's quest for understanding. Language Discovery Environments favor the latter. Teachers should encourage discovery and interact with students in ways which the IAV systems cannot. One of the most important roles of the teacher is to monitor pronunciation and the evolution of each student's cognitive working model of the functioning of the target language system and to apply strategies for correcting errors without inhibiting further expression and discovery. The problem with some earlier and current roles for teachers is the focus on integration over the interval of 1 to n students, n being the class enrollment, rather than

on differentiation over that same interval. In other words, the presence of IAV systems should have a humanizing effect by allowing teachers to become personal guides for each student rather than group tour directors.

Student/Teacher Ratio: By offering a greater variety of options for students and teachers Discovery Environments should serve as extenders and multipliers of the teacher's energy and skills. These options allow teachers to tailor their roles to fit their own strengths and preferences. Likewise students can tailor their interactions with the language samples to their own learning profiles at the very moment of interaction. In such a context teachers should be able to deal more effectively with larger groups than is possible with the conventional instructional paradigm.

Location: Hypothetically the ideal location is in-country or, barring that, in a target-culture micro-society created via language houses, the banning of mother tongue communication, etc. However, the possibility offered by IAV of interacting with a significant sampling of the target language should reduce somewhat the criticality of location.

Facilities: Conditions for language discovery are enhanced if IAV study stations are located in the class meeting area. Teachers can group students in several different ways to capitalize on various strategies, provide variety, and encourage peer interaction. For example, part of the class might interact with the IAV equipment, either individually or in small groups, while another group of students interacts with each other and yet another with the teacher. In some cases this arrangement may actually help save space and reduce equipment requirements. First it may eliminate the need for a traditional central lab facility. It also makes it possible to get along on a system/student ratio of 1/2 or less, especially if students double up on study stations while at the same time other students are involved with the teacher or with other students. It also helps diminish or eliminate the dehumanizing isolation typical of traditional lab configurations where design and older technology work together to separate teachers from students and students from each other.

Time: In Discovery Environments time becomes especially significant as students encounter and explore a much larger amount of language than in most other approaches. Time can take on a criticality typical of immersion courses where students often feel overwhelmed with the amount of material they must assimilate. When a Discovery Environment is part of an immersion course, students may even encounter absolute limits to speed of acquisition as the amount of new material encountered during exploration of numerous and extensive language samples demands more REM sleep assimilation time than is normally part of the student's lifestyle. Thus one may have to think not only in terms of contact time in the course but also of time elapsed between study sessions as well as personal mental health and the states of consciousness which fill the extracurricular hours.

The Written Language

Since IAV is often thought of as useful only for listening comprehension, the function of the written language in a Discovery Environment requires special consideration. Initially the written language should be used in ways which help the student gain proficiency in listening comprehension. The proper design of IAV materials helps eliminate the relatively artificial divisions between reading, writing, and listening activities. For example students may be given the ability to manipulate language macros--words, clauses, sentences, and paragraphs--to recreate or complete a textual rendering of an audio or audio-video sample of the target language. Such activities avoid the problems associated with producing written language a letter at a time, either by hand or via a keyboard, a character map or some other entry approach.

To maintain focus on the target language rather than on the student's own native-language thought patterns, personal compositions on the student's life and interests outside of class should be avoided until adequate proficiency is developed. Instead, the focus should be on activities which involve first re-creation and later modeling or modification of selected master texts or transcripts of audio-video samples. Thus students will have the opportunity to focus on good style and ideas rooted in the target culture rather than on their own ideas conceived in their own frames of reference and formulated in their own language.

Acquisition and Learning

The relationship between Discovery Environments and Stephen Krashen's second language acquisition theory raises the question of the place of both learning and acquisition in such environments. The classroom model of instruction tends to create artificial polarization between acquisition and learning activities. Proper environment design allows both to occur synchronistically with one another and more efficiently than in the standard classroom. To see how Discovery Environment design relates to acquisition and learning, we will first consider some issues relating to the amount and type of input, then input access and control, next "i+1" input and comprehension, and finally input and learning and input and testing in a Discovery Environment.

Amount And Type Of Input: Overexposure and simulations each take on particular significance in Discovery Environments.

Overexposure: A corollary to relatively small samples is overexposure or over-learning. Such a technique is high in opportunity costs. Students are deprived of options to explore and discover the language because the program of study takes teaching rather than discovery as its primary orientation; here is a sample of the language; here's what it means; here are the important grammar elements; here is how they work; now do this exercise; repeat this sentence; etc. Students are being pushed or pulled on a guided tour, even when the program is self-paced. This may interfere with taking personal possession of the language. Acquisition will be enhanced when students have the opportunity to discover how the language works through their own exploration of a larger sampling than is available in most courses.

Simulations as Sources of Input: Are simulations of conversations good ways of increasing input quantity for language discovery?

The essence of a language simulation system is that the system places the student in a conversational situation and assumes the role of conversational partner. If acquisition is indeed a function of input, then such simulations are not likely to fare much better than traditional approaches to teaching since they, too, involve a relatively small amount of original input. This does not, of course, have to be so, and there is no *a priori* reason why language simulations could not be part of discovery learning. However, the expense of developing good language simulations results in very high opportunity costs as compared to the amount of input which can be made available at the same cost when either developing original samples of the target language or adapting existing materials.

Another shortcoming of simulation systems is that thus far they have been unable to truly simulate a conversational exchange between the student and a native speaker. The first reason for this is the hardware and software design problems in the real-time processing and recognition of free-form speech. The next difficulty is that of responding intelligently to what the student has just said. The complexity of software design for generating such replies adds yet another dimension of expense to the development of conversation simulators.

Input Access And Control: In addition to a large sampling of the target language what else is necessary for creating Discovery Environments?

Large quantities of input are a necessary but not sufficient condition of acquisition. Exploration of the input is necessary for acquisition to take place through discovery. Exploration implies access. Students must have easy access to the language samples used in the course. Easy access means rapid and accurate random, not sequential, access. Thus access to a collection of language tapes does not qualify as easy access by this definition since audio tape is a linear-access medium. If a student wishes to work with material from the second and last fourths of a particular tape, considerable time and attention may be required just to access the material. Films, video tapes, and film strips all share the same linear access problems as audio tape. In addition projection equipment may not be accessible to students. In some cases rental materials are used which cannot be kept for extended student use. Real-time viewing of broadcast TV offers no access and control for exploration. Working with tapes of broadcasts entails the same linear access problems mentioned above plus the legal requirement to erase such recordings no later than 45 days after the date of recording. To overcome such problems Discovery Environments must first place IAV equipment at the disposal of students and then provide a large selection of target language samples complete with clear and comprehensive tables of contents.

Menus for Acquisition: What is the importance of the tables of contents mentioned above? To best contribute to acquisition, multiple tables of contents or menus should be provided for each language sample. The master menu would allow students to select the manner of exploration. In addition to free exploration of the sample, students could opt for focused exploration based on various aspects of the language. Choices might include structured access to all the occurrences of some specific functional, syntactic, lexical, cultural, or thematic feature of the language sample, for example all occurrences of the subjunctive, or an important vocabulary item or specific function such as asking for information. The ideal would be to furnish something of a relational audio/video database which would allow the student to explore the sample relative to any or all of its various subdivisions and component parts. Acquisition would be fostered as students compare and contrast different ways of expressing similar ideas or differing uses of a specific element of the language.

Sample Size and Storage Density: What is the relationship between the design of focused menus or a relational audio/video database and the size of a specific language sample?

For the linguistically focused menus to significantly enhance acquisition they must draw from target language samples large enough to make exploration, comparison, and contrast worthwhile. Thus language storage density becomes an important issue unless one has access to some audio-video storage medium of enormous capacity. This is particularly true in the context of typical video production where video alone may take up much more time than video with voice. In such a case a thirty minute program might contain less than fifteen minutes of speech. This may prove to be too small a sampling to provide the number of occurrences of any given element of language or culture required for effective exploration through focused menus or an audio/video database.

Increasing Language Storage Density: How can one increase language storage density? Several possibilities are the filmstrip technique, the second audio track, still-frame audio, and digitized audio.

The Filmstrip Technique: One way is to use a filmstrip approach. This does not mean however exclusive use of still pictures or drawings. It should be possible to edit existing video or produce new video in a filmstrip or comic strip format by including only those video passages accompanied by speech. All the visual transitions would be compressed or eliminated. Such an approach should make it possible to shrink a two-hour movie down to about 30 minutes. Students could alternate between exploration of the compressed version of a movie or other video document and linear viewing of portions of the uncut version to pick up important visual context.

The Second Audio Track: Another way to increase language storage density is to make effective use of the second audio track. A very cost-effective use of audio 2 is for audio-only material rather than for additional audio designed to accompany the video. Thus track 2 could be a valuable resource for many useful audio activities such as interactive telephone and radio or audio support for workbook exercises or even traditional lab-type drill and practice and listening comprehension work. The use of track 2 for revoicing passages from track 1 has a very high opportunity cost since it eliminates all these audio-only options. Also when students have problems with material from audio 1, the repeated exposure and additional helps available through the exploration vehicle plus the linked references can eliminate the need for revoicing.

Still-Frame Audio: Another option for increasing language storage density is still-frame audio, a technique whereby some of the space on a videodisc which could be used to store frames of video is used to store audio. A still-frame audio system can down-load this audio into a buffer then play it back during the presentation of a frame of video. Still-frame audio is good for slide-show type presentations and audio-visual databases. But due to the need to periodically download new audio material into the buffer, still-frame audio is ill suited for maintaining normal rates of language exchange during a protracted conversation. Also the growth of still-frame audio seems to have been hampered by the lack of an industry-wide standard.

Getting Around the Problem: In addition to finding ways of storing more audio on each side of a videodisc, one can provide additional audio from other devices. Compact audio disc could be one such source. CD-ROM and digital audio could also help meet the need. In every case where the necessary equipment and software can be made available these options should be pursued.

I+1 Input And Comprehension: The $i+1$ theory is an important component of Krashen's theory of second language acquisition: how do we move from stage i , where i represents current competence, to $i+1$, the next

level? The input hypothesis makes the following claim: a necessary (but not sufficient) condition to move from stage i to stage $i+1$ is that the acquirer understand input that contains $i+1$, where "understand" means that the acquirer is focussed on the meaning and not the form of the message.

We acquire, in other words, only when we understand language that contains structure that is "a little beyond" where we are now. How is this possible? How can we understand language that contains structures that we have not yet acquired? The answer to this apparent paradox is that we use more than our linguistic competence to help us understand. We also use context, our knowledge of the world, our extra-linguistic information to help us understand language directed at us. (Krashen, 1982)

When selecting audio/video documents for the target language sampling, how does one ensure an $i+1$ match between materials and students?

This $i+1$ input which Krashen posits as required for acquisition is probably the single biggest problem with implementation of the theory. The nature of classroom instruction is integration over the interval of 1 to n students. In this context the $i+1$ match is impossible because $i+1$ is different for each student. It is impossible for a teacher to present simultaneously different selections of $i+1$ input.

Another approach is creating a system which would know each student's level at all times and be able to match it with exactly the right input. Such a system would be quite costly to develop.

A more cost effective path is to use the Exploration Vehicle and Linked References to provide options which make it possible for students of varying levels to come to adequate comprehension during exploration of the same audio/video sample. The first option might be to request repetition, then repetition along with the textual representation of the language. After that, other helps could be made available. A translation of the utterance in question along with commentary on any special considerations may be a cost-effective approach. Although in the traditional instructional setting, translation generally runs counter to acquisition, in an IAV setting this need not be the case. The translation can be made available only on specific request by the student after having experienced both the audio and text versions of the utterance. The cognitive dynamics of this use of translation in an individual exploration mode may furnish a very efficient temporary bridge between what the student already knows and new elements of the target language. The richness of the IAV context--audio, image, and text--should mean that once the gap is spanned and the void crossed, students will not need to fall back again and again on translation of the same passage as often occurs in a more conventional setting where the poverty of context makes it likely that translation will become an indispensable crutch.

However for those who do not accept translation or who wish to include other options, the most alluring is probably the concept of a target language database. Such a help would allow the student to query the system for lexical and grammatical explanation of any problem word or structure. The creation of such a database is a non-trivial task. As an alternative in the context of a Discovery Environment, the student could call on the teacher for help in coming to comprehension. Another option is to encourage students to use their text books and dictionaries as helps during their IAV explorations.

Input And Testing: What type of tests are suitable for Discovery Environments? "Gate checks" are essential in language discovery. It's possible for students to move too rapidly through a language sample and leave before achieving adequate familiarity with the material. Intercept, Interdict, and Scramble are activities which can be used as exercises to allow students to strengthen their grasp on the interrelations of words within the utterances of a sample or as gate checks to see if students have developed enough familiarity with the sample at hand to move on to new material.

Intercept, Interdict, and Scramble: Intercept requires a student to identify the occurrence or non-occurrence of some specific feature of the language - grammatical/syntactical, functional, cultural, etc. The first portion of this activity involves pure listening comprehension. After hearing a passage, the student must decide whether or not the target feature occurs in that particular passage. Next the student sees the text of the utterance from which the feature in question, e.g. a specific verb, is missing. No blank is left to indicate the place in the utterance from which the feature has been removed. The student must first indicate where the missing feature should be re-inserted to make the text of the utterance consistent with the audio stimulus. The student then must type in the

correct form of the missing feature. When this is successfully completed, the system replays the audio stimulus and displays simultaneously the completed text of the utterance.

Interdict is similar to a Cloze listening comprehension exercise, but as in Intercept the blanks are not provided. Also a student may probably play this game/do this exercise several times since the words deleted from the text are chosen anew at random on each pass through the activity. Finally there is "Scramble" which requires students to rearrange the scrambled components of a passage in their proper order according to the audio stimulus.

There are certainly other possible gate check activities, but Intercept, Interdict, and Scramble are particularly worthy of note since they can be generated by exercise engines which operate on the text files corresponding to the specific sample materials rather than by customized programming for each language sample and exercise.

The correlation between such activities as Intercept, Interdict, and Scramble and comprehension may be high but is obviously not direct due to the nature of the activity. A more direct check for comprehension developed by Mr. Fares Nasri of the Defense Language Institute would be multiple-choice questions focusing on the student's understanding of the linguistic function of selected component passages of a language sample. These questions could be posed either in target or native language.

The key to success in developing other types of gate check activities is to ensure that they reduce or eliminate the dichotomy between learning and testing and that they are integrally related to exploration and discovery of the language.

Theory

What theoretical basis can be laid down for Discovery Environments? A useful theoretical foundation should include a theory of learning, a theory of language, then a theory of language learning/acquisition and the definition of an approach consistent with these theories.

Theory Of Learning: Widdowson (1984) in his article "Criteria for Course Design" states, "A process-oriented approach...can only be pursued by reference to some idea about how people learn" (p. 6). Implicit in the concept of Language Discovery Environments is a learning process whereby students discover how a language functions from experiencing, exploring, and using it. Such discovery may resemble cognitively the process of discovering fundamental principles in the sciences and other disciplines. It may also be the most intensely personal and enduring type of learning.

Ideally, discovery learning recreates for every student the experience of revelation when either progressively or suddenly from what one knows one learns what one did not know. This is a primary justification and seldom realized goal of labs in the physical sciences. Foreign language labs seem to have taken their name from a totally different aspect of the physical science lab - a place other than the classroom where all the equipment is kept. Hopefully it will be possible through the appropriate selection of methods and media to reunite lab and class in an environment of discovery where inductive learning of the "Eureka" variety can become a not uncommon occurrence.

Theory Of Language: Language can be considered as analogous to music. People who hear normally and who have been exposed to pleasing examples of foreign language and music often aspire to proficiency in both. Several powerful high-level drives may be at work in creating this desire, such as the appetite for beauty, the appetite for superior status, and the appetite for self-expression. It is likely that the latter is the most widespread and fundamentally powerful of the three. A Discovery Environment should be designed to tap these powerful drives as well as the more obvious surface motivations associated with such practical matters as education and work.

Theory Of Second Language Acquisition: As indicated earlier, Stephen Krashen's Monitor Model or "Input Model" (Underwood, 1984) of second language acquisition is a cornerstone of Discovery Environments.

The input hypothesis runs counter to our usual pedagogical approach in second and foreign language teaching. As Hatch (1978a) has pointed out, our assumption has been that we first learn structures, then practice

using them in communication, and this is how fluency develops. The input hypothesis says the opposite. It says we acquire by "going for meaning" first, and as a result, we acquire structure! (Krashen, 1982)

John Underwood (1984) makes clear why this should be so as he quotes another leader in the foreign language teaching profession:

The implications of this distinction for language teaching should be obvious. Says Earl Stevick, one of the most respected writers on foreign language teaching, it is "potentially the most fruitful concept for language teachers that has come out of the linguistic sciences during my professional lifetime" (1980, p. 270). Why? Because all these years, we have been unwittingly concentrating on trying to get our students to "learn," when what we wanted them to do was "acquire." We were using learning activities when we could have been using acquisition activities. What they did acquire through this process (some a little more than others) was purely accidental, occurring, according to the hypothesis, only because our learning-centered instruction also incidentally provided understandable input. (pp. 13-14)

Approach

Thus in Discovery Environments students "acquire by 'going for meaning' first, and as a result,...acquire structure!" (Krashen, 1982, pp. 20-21) In other words progression should be from language as a whole to language as component elements. Cortes (1984) defines this contrast as one between "systemique" and "analytique" (pp. 1-2). In the same article Cortes goes on to compare and contrast the systemic and analytical approaches which he considers complementary not mutually exclusive. The key is to take an approach which gives primacy to language as a functioning system rather than to individual component parts which can be isolated through analysis. Analysis is not precluded but rather accorded its proper place, which is to help the learner discover, understand, and assimilate the structure revealed in the globality of the second language.

Wilkins (1976) makes much the same distinction as Cortes but using differing terminology. What Cortes calls "systemique" Wilkins would probably refer to as "analytic" whereas the equivalent of "analytique" in Cortes' lexicon would be "synthetic" for Wilkins. The contrary uses of "analytic" is, of course, confusing and makes one wish the French and English worlds of language learning theory could cooperate a little more closely.

Russo, Abbate, and Lydgate (1987), adopting terminology independent of both Cortes and Wilkins, contrast holistic and atomistic approaches in their discussion of the "Referential Approach" which serves as the basis for the Capretz method:

Above all,...the acquisition of a language does not merely entail learning grammatical structures but depends on a complex system of verbal and non-verbal communication, gestures, looks, attitudes, behavior, intonation, and cultural conventions and assumptions. Total language teaching is holistic rather than atomistic, *referential* rather than linguistic... (p. vii).

Thus the approach upon which Language Discovery Environments are to be built requires that language always be introduced in a Systemic-Analytic-Holistic manner. The teacher is not the primary model of correct language for the student. Many models are available to the student via IAV and other media. Nor does the teacher teach grammar to the class as a whole. Only when it is necessary to help individual students correct their own models of how the language works, does the teacher address Synthetic-Atomistic considerations.

Method

To choose or develop a method appropriate in Language Discovery Environments it is helpful to distill the essence of the preceding discussion on theory and approach into a list of four fundamental tenets:

1. Post-adolescents as well as children can acquire language.
2. Discovery is the best basis of acquisition.
3. Systemic-Analytic-Holistic input activates discovery.
4. Atomistic analysis maps newly discovered features of the language into the student's cognitive structures.

Two methods which seem in consonance with these principals and which are also represented in materials richly enough supported with audio and visual media to serve as the basis for developing prototype Discovery Environments are the Capretz method as manifest in *French in Action* and the Structural-Global/Audio-Visual method as applied in the Hatier-Didier Modern Standard Arabic course *From the Gulf to the Ocean*.

The Capretz Method: A summary discussion of the Capretz Method is found in "Part 1" of the *French in Action* "Instructor's Guide" (Russo et al.: 1987):

The objective of *French in Action* is total language teaching through planned immersion - the presentation of French language and culture in a way that simulates the experience of actually being in France... Above all, it makes [students] aware that the acquisition of a language does not merely entail learning grammatical structures but depends on a complex system of verbal and non-verbal communication, gestures, looks, attitudes, behavior, intonation, and cultural conventions and assumptions (p. viii).

The Structural-Global/Audio-Visual Method: Structural-Global/Audio-Visual (SG-AV) methodology developed over the past two decades by the "Centre de Recherche et d'Etude pour la Diffusion du Français" (CREDIF) is generally unknown to U.S. scholars. Richards (1984), however, does refer to this method in his article, "The Secret Life of Methods": "...the Audio-Visual Method received the sanction of the Département de la Coopération through its widespread use of the series *Voix et Images de France* for teaching French abroad" (p. 15).

It is important to note that *From the Gulf to the Ocean* is a third or fourth generation SG-AV course and is based on much more recent theories and practices than was *Voix et Images de France*. In fact *From the Gulf to the Ocean* may be the best example of SG-AV methodology presently available. Cortes (1981) provides a good explanation of "structural global:

...It's because the brain functions in a structural manner that the teaching of a language should take into account this type of functioning. By thus posing his structural problem, Guberina puts himself several light-years ahead of American structuralism... (p. 254).

Cortes (1981) then goes on to explain what is meant by global:

Global signifies, among other things, that there can be no structure without situation, that is without a vast context consisting of the individual placed in a learning situation confronted by a whole sheaf of interactions: the interlocutors, their affective relationship, the type of social interplay they maintain, the subject about which they are speaking, in which circumstances, with what intentions, etc...in short, all the psycho-social-ethno-semio-linguistic-didactic ingredients... (p. 254). (Both passages from Cortes translated from French by the author)

Curriculum And Syllabus Design

How do curriculum and syllabus design relate to the development of Discovery Environments? The answer to this question hinges on three factors: 1) The context of curriculum and syllabus design; 2) The role of the type of detailed needs analysis proposed by Munby; and 3) Alternatives to Tradition.

The Context Of Curriculum And Syllabus Design: In order to understand the process of constructing this type of syllabus, it is best to start at the next higher level in the language-learning/language-teaching process, that is by examining the overall process of planning a second-language program (Yalden, 1983, p. 88).

The importance of articulating course sequences not just in the setting of a second-language program but rather in the broader context of the over-all program of instruction or training should always be clearly, specifically, and openly addressed before embarking on design and development activities relating to any course within that program. The designers should obtain or create a map of all course offerings and if various tracks through the program are possible map them out. Even in the case of designing a stand-alone course which is not related to a larger program at all, the designers should give careful consideration to any prior or subsequent training or education which might relate to the course in question.

Munby's Place: "External considerations thus make the fully detailed Munby-type investigation quite impractical for most program planners, at least for the time being" (Schutz & Derwing, 1981, p. 32).

After studying Munby's complex needs analysis breakdown, one wonders how if ever one could put all those pieces back together to form a meaningful course. Wilkins (1976) expressed "Reservations about synthetic approaches...in which the different parts of language are taught separately and step-by-step" (p. 7). Then Widdowson (1979) criticizes Wilkins for his "notional rather than structural isolates [which are] isolates all the same" (p. 248). With a needs analysis "à la" Munby, is not the danger great of ending up with a course based on yet another category of isolates?

Another danger with the Munby approach is that it may result in a goal rather than process-oriented course.

A goal-oriented approach focuses on describing the special language a learner needs to know. A process-oriented approach focuses instead on describing the way a learner appears to acquire knowledge and allows that process to define course content. Widdowson argues that the goal-oriented approach is ineffective in that it attempts to implant language as an end product in the learner rather than activating strategies in the learner that allow him or her to acquire that language" (Schmidt, 1981, p. 201).

Nunan (1985) also favors a process-oriented syllabus and has critical words for Munby:

...most of the teacher-based needs analysis will take the form of informal monitoring by the teacher during course delivery. This informal monitoring is in contrast to the extensive pre-course analysis suggested by people such as Munby (1978)... there is something almost contradictory about needs analysis which does not involve the learner... a process syllabus allows for recognition of the fact that this sort of qualitative analysis develops over time (p. 4).

On the positive side of the ledger, the systematic structure of the Munby needs analysis would seem to make it well suited for selecting or designing language samples. It might also be used in the design of CAI materials. But in either case if the materials thus designed, however good they may be, are simply plugged into a language teaching environment as opposed to a Language Discovery Environment or some alternate paradigm, net improvement is likely to be minimal. If in fact a new paradigm is what is really needed, to design new materials or even curricula and syllabi for the old paradigm is to waste good effort on a bad model.

Alternatives: Anthony (1963) attempts to provide a hierarchical structure as a basis for developing models of language instruction: "The arrangement is hierarchical. The organizational key is that techniques carry out a method which is consistent with an approach..." (p. 63).

Yalden (1983) offers syllabus design as a superior approach: "Rather than sticking to the kind of procedure which involves an ordered progression from 'approach' to 'method' to teaching 'technique' (Anthony, 1972), it is possible to think in terms of syllabus design" (p. 18).

But is Yalden's style of syllabus aimed at creating yet another classroom language course? After all, the best the classroom can do is proffer generalized answers to specific needs, or in other words language teaching environments force integration over the interval of 1 to n students. "Since not all individual needs can realistically be satisfied by any program, the best to be hoped for is the development of a number of alternative instructional 'tracks'..." (Schutz and Derwing, 1981, p. 33). Student reactions in such a situation are predictable. They of course will seek individual differentiation rather than integration across the group:

we all know that learners have an irritating tendency towards independent action and will frequently follow their own patterns of learning behavior in spite of the teaching patterns imposed upon them. In

the classroom what commonly happens is that the teacher busily tries to change the learner's process into a product and the learner busily tries to change the teacher's product into a process. The teacher attempts to get the learner to put the language data in store and the learner keeps on converting it into energy to drive his or her own acquisition strategies (Widdowson in Selenker et al., 1981, p. 5).

As Yalden (1983) points out: "[Candlin] goes on to say that ..., the learners are themselves analysts of language and will devise their own rules of behavior from approximations to authentic language data that are presented to them in class as well as from their own experience" (p. 80).

And Wilkins (1976) states: "...since we are inviting the learner, directly or indirectly, to recognize the linguistic components of the language behavior he is acquiring, we are in effect basing our approach on the learner's analytic capacities" (p. 14).

This focus on the learner's ability to acquire language through individual discovery points to the need to develop new language acquisition settings - such as Language Discovery Environments - where the individual attention and intelligence of the teacher coupled with the capacities of IAV will respond better to learner needs than the present classroom.

In Closing

The central premise of this paper is that a paradigm shift is essential if interactive audio/video is to be effective in improving the conditions of language learning. Hopefully readers will be able to map the ideas presented here back into their universe of thought and then propagate their own views on the correlations and inconsistencies they discover.

References

- Anthony, E. M. (1963). Approach, method and technique. *English Language Teaching*, 17. (Quoted in J. C. Richards and T. S. Rodgers (Eds.) 1986 *Approaches and Methods in Language Teaching*. New York: Cambridge University Press.)
- Cortes, J. (1981). *L'ancien Et Le Nouveau Testament De La Didactique Des Langues*. Paris, France: R.P.A.
- Cortes, J. (1984). *Approche Systemique En Didactique Des Langues Etrangeres - Un Exemple: Un Niveau Seuil*. Aix-en-Provence, France.
- Knowledge disc (1982). Monterey, CA: Grolier Electronic Publishing and Activenture Corp.
- Krashen, S. D. (1982). *Principles and Practice in Second Language Acquisition*. New York: Pergamon Press.
- Nunan, D. (1985). *Language Teaching, Course Design, Trends and Issues*. Australia: National Curriculum Resource Center, Adult Migrant Education Program.
- Papert, S. (1982). *Mindstorms*. New York: Harper & Row Basic.
- Russo, A., Abbate, T. & Lydgate, B. (1987). *French in Action: A Beginning Course in Language and Culture - The Capretz Method - Instructor's Guide - Part I*. New Haven, Connecticut: Yale University Press.
- Richards, J. C. (1984). The secret life of methods. *TESOL Quarterly*, Vol. 18, No. 1, March 1984.
- Schmidt, M. F. (1981). Needs assessment in English for specific purposes: The case study. In Selenker, Tarone, & Hanzeli (Eds.) *English for Academic and Technical Purposes*. Rowley, Massachusetts: Newbury House Publishers, Inc.
- Schutz, N. W. & Derwing, B. L. (1981). The problem of needs assessment in english for specific purposes: some theoretical and practical considerations. *Languages for Specific Purposes*. Rowley, Massachusetts: Newbury House Publishers, Inc.

- Underwood, J. H. (1984). *Linguistics, Computers, and the Language Teacher: A Communicative Approach*. Rowley, Massachusetts: Newbury House Publishers, Inc.
- Widdowson, H. G. (1979). *Explorations in Applied Linguistics*. London: Oxford University Press. (Quoted in Yalden [1983]. *The Communicative Syllabus: Evolution, Design & Implementation*.)
- Widdowson, H. G. (1981). English for specific purposes: criteria for course design. In Selenker, Tarone, & Hanzeli. *English for Academic and Technical Purposes*. Rowley, Massachusetts: Newbury House Publishers, Inc..
- Wilkins, D. A. (1976). *Notional Syllabuses*. Oxford: Oxford University Press.
- Yalden, J. (1983). *The Communicative Syllabus: Evolution, Design & Implementation*. New York: Pergamon Press.

Videodisc Authoring Software for Foreign Languages: Evaluating Needs and Features

Joel D. Goldfield

Plymouth State College;

Fellow in Foreign Languages

University of North Carolina-Chapel Hill's Institute for Academic Technology

Introduction

Interactive video requires complex hardware and software, but can reward the learner with individualized, effective, multimedia instruction. This chapter presents evaluative criteria and pedagogical considerations to teachers and other potential authors seeking to create their own software lessons or "courseware." Our readers will most likely be those already possessing at least some familiarity with both foreign language pedagogy and computer use.

Hereafter called "IVD", interactive video requires the use of either a videodisc player or a special videotape player ("IVT") controlled by software and a microprocessor, although the microprocessor can be an integral part of the player ("Level 2"). The Level 3 configuration for a videodisc player and a separate computer with monitor(s), is the most common one for IVD. Since colleagues describe hardware details elsewhere, this chapter concentrates on the software, that is, on the pedagogical connection implicit in authoring systems and authoring environments in general. But rather than offer a consumer report, since the authoring packages, their prices, and the equipment they help control can change rapidly, we describe and analyze features and performance criteria directly affecting prospective authors and their students.¹ We ask the reader to bear in mind that since there are hundreds of authoring packages, we would not have had time to teach our classes nor write this chapter had all of us chosen to learn all of them thoroughly! For there is an important, affective consideration: when the lesson application and delivery station are well-designed, interactive video use is nearly transparent and thus not intimidating to the student. Krashen and Terrell's (1983) studies on the negatively stimulated affective filter's inhibitory effects on language learning and acquisition in the classroom would intuitively seem to apply to CALL/IVD as well.

The choice of one's authoring software will usually have long range consequences, especially regarding prospective authors and collaborators, software add-ons and equipment. Considering the wealth of authoring packages available, this initial decision can be momentous. One need only consider the sample list of 37 authoring packages compiled and very briefly evaluated by Tyre (1988) or the list of 62 that appears in *Instruction Delivery Systems* (1989) to anticipate an information overload. Furthermore, since authoring software is constantly updated, any extensive comments on missing tools or other weaknesses would probably soon become obsolete. However, this author hopes that the specificity of his experiences and those of the colleagues who contributed to this report will aid our readers in establishing priorities for choosing authoring packages with which to create interactive video programs.

Encouraging news for teachers who sense that classroom and small group language learning is best complemented by IVD work comes from unexpected quarters. Drs. L. Jones and S. G. Smith (1989), Professors

¹ This author wishes to thank Prof. Nick Eastmond, who has contributed much to the present report. The following four individuals have also supplied important information, particularly through their presentations in a consumer report on authoring systems organized by Prof. Eastmond at the 1989 CALICO Symposium, which was held at the U.S. Air Force Academy: Dr. Bill Fletcher (US Naval Academy), Dr. Carla Meakill (University of Massachusetts), Mr. Jeff Mitchell (Utah State University) and Dr. John Underwood (Western Washington University).

of Chemistry at the University of Illinois at Urbana-Champaign, report in perhaps the most complete academic testing of IVD in any discipline that both non-engineering and engineering students using both IVD and hands-on experimentation in a beginning chemistry course made impressive gains over IVD-only and hands-on only control groups.²

Preliminary Definitions And Choices

What Is An Authoring System? "Authoring software" or "authoring packages" can be divided according to their general flexibility and power, the two principal attributes outside of their price and the potential effectiveness of their derived courseware. Let us define "flexibility" as the number and types of features in the authoring software, such as color, fonts, control of hardware peripherals (CD-ROM players, videodisc players, VCR's, etc.), error-judging capabilities, quiz templates such as true/false, multiple choice, fill-in structures, and many more. Judgement as to an authoring package's power is highly subjective and depends chiefly, for this author, on the type and depth of features simultaneously supported, their ease of use (a time/performance ratio), and the speed of execution of commands in conjunction with hardware for both authoring and courseware use.

Authoring software can be divided into templates, application systems, authoring systems and authoring languages (Merrill, 1985) in increasing order of range of features, and thus, of complexity and time needed to author equivalent lessons. These software types contain instruction sets on a higher order than those in a programming language such as PASCAL, BASIC and C, which may have been used to create the authoring software and which, in turn, are constructed from an assembly or machine language which directly addresses the computer chips. This author considers extensive branching capability as well as author-specified answer judging using Boolean combinations (or/and/not statements, etc.) to be *sine qua nons* of any authoring system and an indication of its power. We can conveniently consider branching and Boolean logic (named after nineteenth-century English mathematician George Boole) simultaneously.

Boolean operators are logical "arguments" such as "AND", "OR" and "NOT." The symbols "&", "||" and "!" typically represent them in programming and authoring languages as well as in many authoring systems. These operators appear most in evidence during the three majors types of branching: conditional, unconditional and random. As indicated in the features list toward the end of this chapter, conditional branching entails a threshold "trigger." Students would need to score, for example, 8 out of 10 on a given group of questions in order to advance to another section. The teacher/author may have decided that if students have not been successful enough to meet this criterion, they would be automatically directed to a remedial section designed for the correction of a particular pattern error judged to be the principal cause of their insufficient performance or "failure." This automatic branching is therefore conditional, dependent upon a predetermined criteria threshold.

Perhaps the author decides that first, the learners should be informed of their progress, then allowed to choose remedial work or continuation with the lesson. There are two separate decisions or steps here. The first stage is an example of conditional branching: the author may decide that, after 10 questions, if more than two responses are incorrect, the set of choices (to continue or receive remedial instruction) is offered. The learners' choice itself to branch to the rest of the lesson or to receive remedial instruction is unconditional since at this point, no further criteria-based condition must be met for the branching to take place. If the conditional threshold is met, however, by two or fewer errors, the learners continue the lesson with no proffered option for remediation.

Random branching occurs when there must be a branching action by authorial choice, but to any one or several of all available options. For example, if learners are playing a translation game after mastering various types of homogenous exercises (fill-in, multiple choice, etc.), and the author would then like to mix the types of questions, learners could be randomly branched to a question in any type of exercise after each response. If this

² See also: Jones, L., Smith, S. G. & Waugh, M.L. (1986). Production and evaluation of interactive videodisc lessons in laboratory instruction. *Journal of Computer-Based Instruction*, 13, 117-121; and Smith, S. G. & Jones, L. (1987). Images, imagination, and chemical reality. *Journal of Chemical Education*, 66, 8-11.

branching occurs whether the response is correct or not, one might call the decision, "random, unconditional branching," for no criteria level must be met for the branching to occur. All that must occur is some type of response that cues the program to continue, such as pressing the RETURN or ENTER key.

To illustrate the role of the Boolean operators: if students have answered through question number 20 AND the total number of errors is fewer than or equal to four (i.e., less than or equal to 20% of the total), the program will automatically display a screen showing the results and ask students if they would like to continue to another lesson. The display of the results is an unconditional "branch." It would occur after the student quit the exercise or after the 20th question regardless of the number of correct responses. The query about continuation reflects the author's conditional branching decision. If there are more than four errors at the end of the 20 questions, the author chooses to display a different list of options. This time there is conditional branching to the options. If students choose to continue OR quit, the program displays a screen that this section is "bookmarked" as a point for later review. If they choose to continue, that is, NOT to quit NOR receive remediation, the program clears the previous screen AND branches to the next screen in the lesson.

With the Boolean logic and branching features, an author can usually program the courseware to adjust the level of lesson difficulty as desired according to students' performance level, look for keywords, and suggest strategic remedies for spelling mistakes. Simpler authoring software (i.e., application systems and templates) seldom offers these features. However, there are no common definitions for these software types. This author modifies the sense of Merrill's (1985) "application system" definition to replace the expression "mini-authoring system" found occasionally in use today. It could describe, for example, Judith Frommer's *MacLang* and Stephen Clausen's *Private Tutor*, authoring software specifically designed to create foreign language software.³

Authoring languages are command driven and require the courseware author to learn anywhere from 20 to 300 commands or more. These can be "chained," just as one links keystrokes into a macro within a word-processor. However, with an authoring language, such as Duke University's CALIS (CALL-dedicated), IMSATT Corp.'s *IMSATT 2000*, IBM's *LS 1*, Learncom's *SAM IV* and Computer Teaching Corp.'s *TenCORE*, all with powerful attributes, commands may be linked. Some authoring languages offer a derivative authoring system, such as the icon-based *TenCORE Producer*. Others, like Allen Communications' *Quest* have an authoring language (QAL) designed to complement the authoring system.

In this hypothetical example, an authoring language might play a given videodisc from frame 5,000 to frame 7,000, stop and display frame 7,000 as a still frame while overlaying (superimposing) the computer-generated image found on the software diskette or hard-disk in the program's section 5, frame 3.

Play videodisc 5000-7000; Still 7000; Overlay 5.3

The reader has probably already deduced that an experienced authoring language user could recombine some of its tools to create an authoring system. The latter usually reflects the greater pedagogical attention by the authoring software design team. Similarly, one can reduce the flexibility of an authoring system to create an application system, one that should reflect even more pressing pedagogical needs by culling the appropriate tools. Perhaps the type of commands linked above would simply become "IVD still overlay" or a menu item or an icon (symbol, pictogram) on the authoring screen. One would only need to specify the frame numbers to be accessed, perhaps after a prompt from the application system. Besides guiding the author more efficiently through the authoring process, menus can prompt pedagogical and esthetic choices such as foreground, background and border colors, placement of buttons or hypermedia "hotlinks." Menu screens or menu bars (i.e., high frequency commands listed in a row on authoring screens) are thus characteristic of authoring systems and application systems and templates. Nearly all of the 62 "authoring systems" listed by *Instruction Delivery Systems* (1989) are menu-based. There are few templates given and none provides IVD control. It is not unlikely that the potential complexity of an IVD lesson appears antithetical to a design team in its efforts to maintain the template's simplicity, although this assumption is not always true.

³ Addresses or telephone numbers for all authoring software cited are provided in the Appendix at the end of this chapter.

Templates: The least flexible type of authoring software, but one which greatly speeds up the creation of usable courseware, is the template. It is similar to the writing stencil in its vast reduction of forms, available procedures and other choices. Examples might be any of the *Word Battle*-type packages such as Gessler Educational Software's *Bataille de mots*, *Batalla de palabras* and *Wortgefecht* or, one with a few more pedagogical priorities such as *PROMPT* (see Appendix).⁴ Characteristic of the first set of templates is the ability to add information divided into categories, in this case, nouns, adjectives and verbs. The teacher-authors exit the student mode and enter the authoring one through a "secret" set of keystrokes. They "pour" the information into the prompting template categories, adding sample sentences and translations. Through use of a plus sign ("+"), authors indicate where the word in question is to be substituted. The programming provided takes care of all other functions displayed to the learner, including the menu, instructions, exercises and translation game in a modification of an arcade-style shooting gallery.

Although the creators of low-level, more flexible, templates may make the teacher's task easier by supplying formats such as cloze, multiple choice, alternate answers, on-line dictionary, root-word answer-judging algorithms with "canned" feedback (e.g., *PROMPT*) as well as other features, other choices important to particular users must be sacrificed. As the degree of control over each feature and the number of choices available to teachers increase, so does the time necessary to create a lesson. Fortunately, users of almost all authoring systems and authoring languages can create and reuse their templates and routines to create new lessons in significantly less time.

A partial, high-priority solution to the problematic restrictions imposed by higher-level software is for all authoring software to permit the use of an external command enabling the author to draw in or otherwise control MS-DOS, OS/2 or Macintosh programs. A *Lotus 1-2-3* spreadsheet could have buttons or hot spots that, when activated by a mouse or cursor plus keystroke combination, cue the program to superimpose a graphic over videodisc images with audio as part of a transactional French lesson controlled by the PC version of *Guide* hosting *IconAuthor*, both running under the "umbrella" of Microsoft's iconic *Windows* interface.⁵ In other words, one program can be "connected" to another, and the weaknesses of one authoring system can be compensated for through the strengths of another. Proper "hooks" in the computer code, amount of RAM and the speed of the hardware help determine the effectiveness of this type of solution.

Hypermedia: The hypermedia environment is suitable for the interactive videodisc because its system of multiple, intuitive, "thematic" and weblike linkage lets us imitate the navigations of the mind in associating content and movement from various media. Prof. George Landow (1989a) comments in *The Journal of Computing in Higher Education*: "Hypermedia as a medium conveys the strong impression that its links signify coherent, purposeful, and above all useful relationships" (p. 42). Landow correctly asserts that hypermedia requires careful attention to a rhetoric of navigation in the form of graphic logs and other navigational charts that will provide reliable information to students regarding where they started, where they are, and where they are headed as well as how they are faring. He provides nineteen "rules" for hypermedia linking and orienting the student traveler. These rules, begun in an earlier article for *Computers and the Humanities* (Landow, 1989b), are nowhere more important than in IVD courseware, where full-motion video, graphics, audio and text must be skillfully integrated.

Operating Systems & the Microcomputers that Run Them: There are several authoring packages which operate in either IBM (PC/MS-DOS) and Apple Macintosh environments, with new ones appearing nearly every business quarter. Some packages, like TeleRobotics' *Course Builder*, Owl International's *Guide* and Authorware's *Course Of Action* have versions for both. This versatility is rare.

⁴ Reviewed by this author elsewhere: Goldfield, "PROMPT," *Northeast Conference Newsletter* 23 (Feb. 1988): 15-18.

⁵ Prof. Joseph Feustle has written the most relevant review to date of *GUIDE* for CALL and literary computing. See "Hypertext for the PC and PC-compatibles," *Hispania*, 22, (2), May, 1989: 45-64. Attendees of the 1989 CALICO Symposium found that inventive colleagues at Cornell have expanded the features of courseware written for the Mac version of *GUIDE* by running them under Apple's HyperCard.

As mentioned above, unless we are in a position to order new equipment, our first "branching" decision as to which authoring system or language to learn must depend upon the computer environment which will deliver the instruction. In an ideal world, however, software drives hardware. That is to say that ideally one is better off choosing the authoring software before hardware, first for its pedagogical priorities, learning curve, lack of legal restrictions and price. Unfortunately, we must often deal with the hardware question first and these other attributes in a different order.

We presume that most colleagues plan to run courseware on microcomputers rather than minor mainframe computers, though the distinctions among them grow ever blurrier with each advance in computer chip technology. Although the largest installed base of microcomputers in the public schools is the Apple II series, there are few authoring systems for them, one exception being the *Tutor-Tech Toolkit*. It runs on the IIgs and allows the author to create hypermedia with color in a system of links and "stacks" as in *HyperCard*.⁶ Atari and Commodore (i.e., the Amiga) seem in the great minority except for niches in home video games, the music industry, graphics design and animation. IBM's windowed, RAM-intensive, OS/2 environment is still problematic, but gaining ever wider acceptance. As more users acquire microcomputers equipped with at least 2 megabytes (Mb) of Random Access Memory (RAM), this gain will become more pronounced. The microcomputers that run OS/2 also run MS-DOS software, though not necessarily simultaneously.

Although UNIX is a powerful operating system found especially on university and corporate mainframes, it is found in various metamorphoses on powerful personal computers--on Macs ("A/UX"), IBM PC's and compatibles ("AIX," "Xenix"), on NeXT ("NextStep")--the installed base of personal computers running UNIX is still small. The number of special authoring packages built upon UNIX is thus limited. The number of MS-DOS-based and OS/2 machines seems to be on the rise in the public schools, but their largest base is in industry, government and higher education. In this last sector, second place goes to the Macintosh environment. Therefore, colleagues will probably prefer to concentrate their authoring efforts in the MS-DOS, Macintosh, and OS/2 environments unless they have a particular application or delivery system which dictates otherwise. In any case, the greatest number of authoring software packages exists for microcomputers using these three operating systems, surely reflecting sound marketing research if their companies are still in business.

Authoring Package Features for CALL and Interactive Video

To be thorough, this section must include a considerable number of features that are common to all good authoring systems and authoring languages. The reduction of these possibilities in the creation of an application system and a template reveals narrower and more explicit pedagogical decisions. Saving time and energy must compensate for the reduction of options. An informal interactive video experiment conducted by this author and colleagues over several years indicates that, when using the BASIC programming language, authoring languages (e.g., *PILOT*), authoring systems, application systems, and templates, the same type of lesson required about 100 hours, 30-50 hours, 10-30 hours, 10 hours and 1 hour, respectively. One might wonder why anyone would bother to use authoring software that requires 100 hours to create a one-hour lesson. Again, the flexibility to create a variety of lesson types incorporating many pedagogical and hardware options is the justification. Parts or the entirety of that lesson might easily be integrated into a subsequent one. Furthermore, authoring languages, like authoring systems, vary widely in the specificity and intuitiveness of their commands. These two factors, coupled with the skill of the authors and the time necessary to interface the hardware with the software helps to account for the time discrepancies within software types.

Control of Peripherals: As seen above, the hardware/software interface can play an important role in making or breaking a lesson--both in its creation and in its use. Of prime importance in IVD is the authoring software's control of the appropriate peripheral devices, namely, the interactive videodisc player and interactive tape player. While a very few players may be accessed through the computer's parallel port, most are controlled through the

⁶The "Toolkit" is available from Techware Corp., Altamonte Springs, FL. See, for example, "Multimedia stacks are possible on Apple IIgs," *THE Journal* 17, (4), Nov. 1989, 36. Another authoring system is *Hyperstudio* from Roger Wagner Publishing, Inc.

computer's serial (RS 232C) port or a COM port provided by a board inserted into a slot of the computer. Some authoring packages support overlay boards which use specially designed outlets (plugs) for both monitor and player. Prospective users should check with the manufacturer of the board and the authoring system to be sure that any eclectic configuration will operate properly with their microcomputers and monitors. One also needs to know whether the exact player codes are provided in the authoring software or if the manufacturer intended for these to be present in certain overlay boards. In the latter circumstance, commands are passed along by the authoring program to the overlay board which translates them into the commands needed by the player.

Authoring software can control the player directly by mapping the author's commands such as "Play" or "Search" to the designated model's control codes provided in the software. However, when this author wanted to control the recently released Pioneer LD-V8000, he used an authoring system possessing the earlier LD-V6000 codes. Unfortunately, the superset of commands required to freeze a frame and simultaneously access the audio tracks was, of course, absent. We might at least insist that manufacturers of videodisc and videotape players always supply a diskette containing the appropriate control codes for the client's designated operating system. With the plethora of available models and more on the way, users must sometimes write their own files, which are usually accessed by an external call to the operating system. This extra step may considerably slow down response time, as is the case with Techbyte's *Scénario: Professional Version*.

Pedagogical Priorities for Authoring Packages

Support for:

1. Basic ergonomic considerations:

- * operating system requirements,
- * software available for converting courseware to other operating systems,
- * interfacing capabilities with audio-, video-, and text-based peripheral devices (videodisc and tape players, CD-ROM, etc.),
- * support for input devices (keyboard, mouse, light pen, electronic pen, touchscreen, tractorball, touch pad, paddle, joystick, speech digitization and recognition),
- * speed of execution,
- * multi-tasking (depends on operating environment and hardware),
- * programmable, automatic back-up while authoring,
- * number of keystrokes necessary for selection of menu item or to issue a command,
- * natural, reliable interface,
- * special purpose commands (e.g., "wait," access to external operating system and files, ability to run student lesson from within authoring system),
- * foreign character sets: ability to select, mix, access pictogram-based and other non-Roman languages, cursive forms, right-to-left motion, two-way vertical,
- * ease in modifying lessons (e.g., videodisc frames, adding new ones, adding images from the hard-disk)
- * documentation: user manual, technical manual (including source code), appropriate tutorials for various implementations--IVD, CD-ROM, etc.,
- * reliability (e.g., free from crashes, gives useful error messages).

2. Branching:

- * appropriate help tools (icons, schemas, etc., to log materials),
- * random branching,
- * conditional branching,
- * unconditional branching,

- * performance tracking and lesson individualization: "ready-made," modifiable templates or routines for using weighted responses, criteria thresholds (e.g., if students answer correctly on 80% of the questions in at least 90% of the lesson sections, they advance, if not, the program branches to a remedial section). The number of correct and incorrect responses plus comparisons with previous work on the same materials affect the lesson sequencing. This procedure makes heavy use of conditional branching.
3. Exercise and testing formats provided:
 - * true/false,
 - * matching,
 - * multiple choice,
 - * cloze (fill-in).
 4. Feedback:
 - * variety of reinforcement tools,
 - * answer-judging tools (Boolean arguments, depth of embedded sets, etc.),
 - * error analysis (error trapping, range of character values, spelling),
 - * student record keeping: bookmarking or tagging the point of last exit or any portion the student would like to access again easily; electronic notebook for student's own notes; comment box for suggestions to teacher.
 5. Authoring aids:
 - * planning grid per frame or module,
 - * log for tracking lesson development (type of information, branches, peripherals accessed, etc.),
 - * sample lessons by discipline.
 6. Interface capabilities with information storage devices and media
 - * CD-I,
 - * CD-X,
 - * CD-ROM,
 - * CD-ROM XA (extended architecture),
 - * DVI,
 - * memory units (stream cartridges, magneto-optical devices, DAT-digital audio tape, etc.).
 7. Sound:
 - * both audio channels, various track types applicable to either tape or disc (linear, stereo hi-fi, helical tracks), including audio independently recorded from video. This last feature allows audio material on any audio track to be accessed randomly, independently from video on some players which can maintain a still frame on-screen.
 - * digitized audio,
 - * computer speaker,
 - * special sound chips,
 - * third-party audio boards,
 - * speech synthesizer and digitizer boards,
 - * CD players,
 - * tape players--analog & digital,
 - * random-access audio under video stills. See above. This feature can save the disc designer valuable video space if full-motion video material is not as important as the audio material.

8. Video:

- * text overlay;
- * graphics overlay;
- * split and multiple screens;
- * windows;
- * frame grabbing/digitization;
- * retrieval of frames (from disc, hard-disk, etc.);
- * editing of frame, including color matching, blending and modification, cutting & pasting, rotation, sizing, animation;
- * previewing all arrangements while in authoring system;
- * printing screen in monochrome or color.

9. Graphics:

- * internal graphics editor,
- * ease of access to images stored on hard-disk,
- * support for third-party graphics software formats (PCX, TIFF, etc.),
- * support for peripherals: hand-scanners and full-page scanners, printers, plotters,
- * support for CAD-CAM formats,
- * support for various color standards (Hercules monochrome, CGA, MCGA, EGA, VGA, Super-VGA, etc.),
- * multiple screens,
- * multiple windows.

10. Text editing:

- * strong capabilities and smooth support for a variety of third party word-processing programs from within the authoring system,
- * scalable fonts,
- * mixing of fonts and letter type (bold, italic, etc.) on same screen,
- * mixing of blinking and non-blinking text on same screen,
- * mixing of customizable and standard characters & sizes.

11. Access to source code for customizing screen displays, correcting errors, updating codes (e.g., videodisc player control), etc.

12. Object-oriented data. The authoring system separates program commands from content, allowing for dataset portability and easier modification. The four principal characteristics are: data abstraction (data separated from internal program structure); encapsulation (the process by which program procedures interact with the data); inheritance (a new object can be easily derived from a predecessor) and; polymorphism (the characteristics inherited from a predecessor can be easily adjusted to suit a new situation). For example, the videodisc access sub-routine described above could be "named" or identified with an icon (symbol) as a "mini-program," modified and inserted in any number of other sequences. The author could simply change the frame numbers arranged in a particular order, thus without necessarily seeing the command action sequence ("play," "still," etc.).

13. Networked configuration possibility for authoring system and courseware.

14. Minimum of legal restrictions:

- * no or low royalty charges for commercial distribution of courseware
- * possibility of commercial, user-supported clearinghouse for courseware distribution

- * no need for special run-time diskettes for courseware distribution
- * reasonable site-licensing conditions for the authoring system and for multiple-user, multiple-computer use of derived courseware, especially at authors' own institutions and within their consortia. There should be no restrictions on the sale and distribution of derived courseware.

15. Technical support, including telephone 800 number and version updates for new authoring features, elimination of errors, support for new peripherals and computer hardware.

Summary

Prospective authors may not know which features will prove to be the most important ones after several months or even years of using a particular authoring package. As in classroom teaching, the most important pedagogical and technical tools in IVD are determined by the learners' needs, which may change. The decision schema below illustrates the mixed set of absolute and subjective priorities that this author's foreign language department considered recently in selecting an authoring system for evaluation.

Runs in MS-DOS environment?	☒ YES	☐ NO	
Costs under \$1,500?	☒ YES	☐ NO	
No courseware royalties due authoring system publisher	☐ YES	☒ NO	
Videodisc and videotape control	☒ YES	☐ NO	
All needed features specified in items 1-5 above? (under the "Pedagogical Priorities" section)	☒ YES	☐ NO	
Most options within items 6-10	☒ YES	☐ NO	
Item 11	☐ YES	☒ NO	But the source code is not required if there is responsive publisher support
Item 12	☒ YES	☐ NO	
Item 13	☒ YES	☐ NO	Negotiable network site licenses
Item 14	☐ YES	☐ NO	☐ Mixed result Educational rate charged per station, regardless of number of users and lessons
Item 15	☒ YES	☐ NO	Approved for evaluation and possible adoption ⁷

Almost all of the items identified above should also be available in the student system or courseware. While all of the above features deserve elaboration in an essay on pedagogical considerations for courseware authoring, certain ones are linked more closely than others to IVD use: overlaying text and graphics on portions of or on entire video images, digitizing images to various storage devices, windowing video images, printing screen

⁷ The authoring system in question is *IconAuthor*. A similar branching schema has led us to begin evaluation of SAM IV, with the foreknowledge that there are definitely no royalty and runtime restrictions on derivative courseware.

images, and specifying chroma key ("transparent") colors are probably the most important visual features.⁸ We can separate only with difficulty the concomitant audio features. Adding back all the other possibilities from which the author may choose, we would not be surprised to find colleagues' spare time absorbed by the sheer effort of learning a new authoring system in order to create a lesson. This author expected to find and indeed found language teachers of all types captivated by the technical dazzle of graphics tools, full-motion video and precise, digital audio in CALL workshops conducted in the U.S. and Western Europe. What he encouraged many to remember was the transcendent step: teaching well when one creates a CALL lesson. Below are some guidelines developed from theoretical works and from hands-on experience complemented by conclusions found in Muller, et al. (1988).

1. provide a variety of reinforcement, both in type and media;
2. individualize the level and pace of instruction through the appropriate use of student response data;
3. specify the boundaries of acceptable responses;
4. provide for the inclusion and fading of cues to assure true learning and not cued recognition;
5. provide a variety of exercises with a bookmark feature (point of last exit);
6. provide multiple-point, varied remediation;
7. provide specificity in remediation;
8. support group-oriented input (e.g., polling and multiple, simultaneous entries).

From the prospective author's point of view, there are probably no more important aspects for developing courseware using a particular authoring package than the following nine items:

1. cost;
2. hardware requirements and support;
3. potential legal restrictions;
4. ease of installation;
5. clearness and usefulness of documentation;
6. appropriateness of tutorials;
7. appropriateness of the package's power and flexibility for the intended tasks in view of time to completion of the authoring process;
8. provision of appropriate templates or routines;
9. manufacturer's support network.

The pedagogical characteristics vital to authoring excellent courseware with IVD are also those found in excellent classroom teaching and tutorials, but reduced to, and modified for, the multi-media space of the computer monitor and other peripherals. The psychological/pedagogical features with the highest priority may very well be timing, pacing, appropriateness of feedback and of the use of that feedback for remediation and advancing in the lesson. Perhaps most important of all are students' feelings of empowerment through control of the lesson during individualized instruction. While Muller, et al., deal more with these worthwhile attributes than with IVD per se, their collective wisdom in specifying important "Characteristics of an Ideal Interactive Videodisc

⁸ Chroma key or transparent colors are those which, at the author's discretion, allow videodisc or other video images to appear within a graphic shape created for computer display. For example, a blue porthole in a computer graphic of a ship could be replaced by the image of a person's face stored on videodisc as long as the porthole appears at exactly the spot where the face must and as long as the particular shade of blue is the designated chroma key color.

Authoring System* deserves consideration. When authoring courseware, for IVD or otherwise, we would be wise to bear in mind the items derived from sound teaching experiences, psychological experimentation and observation.

Appendix

Authoring Software Cited:

- Authorware Professional*, Authorware, 8500 Normandale Lake Blvd., Minneapolis, MN 55437.
- CALIS*, Humanities Computing Facility, Duke University, Durham, NC 27706.
- Course Builder*, TeleRobotics, Inc., 8410 Oak Ridge Hwy., Knoxville, TN 37931.
- Guide*, Owl International, Inc., 2800 156th Ave., S.E., Suite 205, Bellevue, WA 98007.
- HyperCard*, Apple Computer, Inc., 20525 Mariani Ave., Cupertino, CA 95014.
- Hyperstudio*, Roger Wagner Publishing, Inc., 1050 Pioneer Way, Suite P, El Cajon, CA 92020.
- IMSATT 2000*, IMSATT Corp., 500 N. Washington St. #101, Falls Church, VA 22046.
- IconAuthor*, AimTech Corp., 77 Northeastern Blvd., Nashua, NH 03062.
- LS/1*, IBM Corp., 4111 Northside Pkwy, N.W., Atlanta, GA 30327.
- MacLang 4*, available from CALI, Inc., 526 E. Quail Rd., Orem UT 84057; Gessler Educ. Software (see below); Research Design Associates, 800-654-8715.
- Private Tutor*, Prof. Steven Clausing, 408 Thoreau Rd., Branford, CT 06405.
- PROMPT* and Word Battle-type templates, Gessler Educational Software, 55 West 13th St., NY, NY 10011.
- Quest*, Allen Communications, 5225 Wiley Post Way, Salt Lake City, UT 84116.
- SAM IV*, Sandy Corp., 1500 West Big Beaver Rd., Troy, MI 48084.
- Scénario. Professional Version*, Techbyte, 547, rue Saint-Thomas, Longueuil, Québec J4H 3A7, Canada.
- TenCORE*, Computer Teaching Corp., 1713 S. Neil, Champaign, IL 61820.
- Tutor-Tech Toolkit*, Techware Corp., Altamonte Springs, FL.

References

- Crowell, P. (1989). Authoring systems, programs, languages. *Instruction Delivery Systems*. March/April, 10-18.
- Jones, L. & Smith, S. G. (1989). Lights, camera, reaction! The interactive videodisc: a tool for teaching chemistry. *T.H.E. Journal*, 16 (7), 78-85.
- Krashen, S. D. & Terrell, T. D. (1983). *The Natural Approach: Language Acquisition in the Classroom*. Hayward, CA: The Alemany Press.
- Landow, G. P. (1989a). The rhetoric of hypermedia: Some rules for authors. *The Journal of Computing in Higher Education* 1, (1), 42.
- Landow, G. P. (1989b). Hypertext in literary education. *Computers and the Humanities*, 23, (3), 173-198.
- Merrill, M. D. (1985). Where is the authoring in authoring systems? *Journal of Computer-Based Instruction*, 12, 90-96.
- Muller, D. G., Levy, L., Nelson, H., & Dean, D. (1988). The role of authoring systems in the development of interactive videodisc courseware. *Journal of Interactive Instruction Development*, Summer, 16-23.
- Tyre, T. (1988). Authoring systems help a teacher offer more personalized education. *T.H.E. Journal* 16, 14-24.

CALL/IVD Workstations: Towards a Rationale for Their Use in Cooperative Learning Environments

Kuan-Yi Rose Chang
West Virginia University
and
Wm. Flint Smith
Syracuse University

Introduction

Researchers in the whole spectrum of classroom learning recognize that quantity and quality of learning are a function of student involvement in the learning process, in addition to contributions made by the teacher, the social milieu, and the interaction between the materials, media and methodology. Learning takes place when the student has a set to learn and interacts meaningfully with a planned learning event (Ausubel, 1963). Learning is similarly aided by purposeful, task-oriented and cooperative large and small group activities. This intra- and inter-student interaction underlies the potential of effective learning in wide range of instructional settings (Malamah-Thomas, 1987).

Researchers in foreign language education stress the significance of interaction between learners (Kramsch, 1983; Rivers, 1987) in addition to student-medium and student-materials interaction for language practice (Ariew, 1987). L2 students who maintain a high rate of purposeful interaction are reported to learn faster and have a lower degree of negative transfer from L1 (Seliger, 1983). Active, as opposed to passive L2 students also demonstrate a higher level of achievement and more positive attitudes towards learning the target language (Seliger, 1983; Verano, 1987). Active student participation in the learning task is therefore an essential factor for effective L2 learning; purposeful, cooperative interaction in a learning event facilitates learning of both strategies and content.

In modern classroom settings, interaction as an instructional strategy can be enhanced through cooperative student-student or teacher-student interaction that incorporates television, computer-assisted language learning or interactive videodisc, or their combination (CALL/IVD), in paired or small-group activities at CALL/IVD workstations. While the physics and physical qualities of the videodisc as a high-density audio and video storage device have been described elsewhere (Thorkildsen and Friedman, 1984), its multiple coding options--still frame, slow motion, instant access to individual frames and strings of visuals, dual audio tracks, video replay, etc.--suggest a range of instructional applications for which L2 materials are just beginning to appear. Cooperative class activities, defined as strategies that encourage interactive peer teaching, and cooperative learning, whereby students work with one or more partners *viva voce* or via modern media, are two methods capable of promoting an efficient and positive learning environment. Similarly, CALL/IVD media, materials and workstation environment add opportunities for increased interaction and the potential for more rapid and thorough acquisition of L2 lesson content. In short, cooperative learning, and CALL/IVD materials and delivery systems are thought to be significant instructional strategies that enhance interaction in a learning event while assisting positive learning outcomes. In this interactive environment, students use of the CALL/IVD workstation becomes paramount for efficient learning to take place.

Understanding the dynamics of this interaction has a direct bearing on the configuration and use of CALL/IVD workstations. This paper explores individual versus cooperative learning using IVD, and CAI and CALL protocols towards establishing a rationale for CALL/IVD workstation application.

Cooperative Learning

Cooperative learning has a long history of investigation in education. Researchers across the full range of disciplines have studied the effectiveness of cooperative instruction on the learners' cognitive and affective development. The various research findings underscore the positive effects of studying with one or more partners in increasing achievement potential (Sharan et al., 1984; Mesch et al., 1986) while promoting security, lessening anxiety and enhancing greater personal gratification in learning (Sharan and Sharan, 1976). Compared to competitive learners studying by themselves, students studying together are also reported to manifest higher academic performance (Johnson et al., 1981), including an enhanced ability to problem solve (Edwards, 1972) and retrieve information from memory (Yuker, 1955). Moreover, cooperative, active learners are also reported to be more productive (Johnson et al., 1981) and are able to accomplish learning tasks more quickly (Fraser et al., 1977) than their counterparts working individually.

From an affective standpoint, cooperative learning, as opposed to individualistic or competitive study, is reported to promote positive attitudes towards the subject matter, instructional objectives and activities, the teacher, and peers (Mesch et al., 1986; Sharan et al., 1984). Cooperative-aligned students are also more apt to reflect peer attitudes and motivation (Johnson et al., 1976), and to acquire a greater sense of camaraderie and develop mutual concerns and group spirit (Slavin, 1980).

Small-group activities and peer tutoring/teaching also have been used effectively in second/foreign language classrooms. In addition to the advantages of cooperative learning in general noted above, L2 investigators have reported additional positive effects of peer teaching in individualized instructional settings (Long and Porter, 1985), reducing learner classroom anxiety (Davies and Omberg, 1987), and engendering classroom environments that promote better achievement (Hartl, 1984) and more functional communication in L2 (Pica and Doughty, 1985). Cooperative small-group activities are also viewed as capable of improving the quantity and quality of oral and written communication in the target language (Omaggio, 1986).

In the affective domain, the social environment inherent in small-group L2 interaction has been found to enhance attitude and motivation (Gunderson and Johnson, 1980) in learning the language. These positive learning outcomes promote comprehension and language usage, and encourage students' active involvement in the learning process.

Whereas cooperative learning in general has been found to foster achievement and positive attitudes towards learning, the role of modern media in the teaching/learning equation has also become increasingly apparent. Interaction and active participation in the learning process can apparently be enhanced by a variety of mediated materials and workstations environments as can be seen in the studies summarized below.

CAI and CALL

Although there are exceptions, CAI software to date has been designed largely in the form of supplementary tutorials, drill and practice exercises, games and simulations. The application of a given type of program depends upon specific instructional objectives in the teaching/learning paradigm. Much research on CAI has been conducted in various subjects to examine the cognitive and affective effects of this medium (Kulik et al., 1986; Eisenberg, 1986; Hedlund and Casolara, 1986). When compared to standard classroom instruction, results generally point favorably to CAI as catalyst in reducing instructional time and eventuating higher achievement. CAI is also reported to promote positive attitudes towards the learning task(s), the subject matter and towards the medium itself (Dalton and Hanafin, 1985; Eisenberg, 1986). Researchers attribute the positive learning outcomes to these purported advantages offered by this instructional technology: (1) active, purposeful interaction with the medium and material keeps the student on task; (2) immediate feedback corrects, shapes or corroborates the student's efforts; and that (3) pacing is self-controlled. Additionally, while CAI medium offers consistent answer-judging and efficient record-keeping capabilities for the teacher, its coding options invite multiple ways for the researcher to study the learner, the learning process, and the learning outcomes.

The results of early CAI research comparing its effectiveness to traditional classroom teaching led to skepticism on the application of the medium to language learning (Olson, 1980). Nevertheless, with the advances

in technology and concept, interest in CALL through the 1980's has remained compelling (cf. Smith, 1987, 1989). Recent L2 authors have documented past successes and offered a host of familiar and promising uses of CALL for the future, including CALL as a medium for helping students practice and develop proficient competence in the target language (Hope et al., 1984; Underwood, 1984; Wyatt, 1983), evaluating competence and performance (Dandonoli, 1989; Larson, 1989), conducting language acquisition research (Garrett, 1988; Pederson, 1987), articulating the foreign language curriculum (Ariew, 1987; Blake, 1987), designing new CALL software (Hubbard, 1987; Evelyn-Ng and Olivier, 1987), and training teachers (Curtin and Shinall, 1987).

Although the many advantages of CAI/CALL have been recognized, its limitations have also been addressed (Ahmad et al., 1985; Ariew, 1987). The lack of an audio component and the low realism of some computer graphics in stand-alone CAI and CALL, and the problems which preclude interactivity inherent in linear, stand-alone video are largely overcome by the advances in videodisc technology (Bush and Crotty, 1989). Interactive videodisc combines the qualities that make CAI a viable instructional environment with the audiovisual qualities of television and film. The combination of CAI or CALL and IVD in a single workstation therefore compensates and complements the advantages and disadvantages of these media by themselves.

CALL/IVD

A large part of research on CAI/IVD to date has emanated from the military or industry where the technology is widely used in management and medical training courses (Ebner et al., 1984). In this arena, as in CAI/IVD-mediated science and mathematics education (Bunderson et al., 1981; Henderson, 1985), results typically show CAI/IVD to be an efficient delivery mechanism for teaching and learning. Users test higher and cover more material more efficiently when compared to traditional instruction and, generally, indicate favorable attitudes toward the medium itself as well.

In L2 teaching, authentic video materials provide visual, paralinguistic and cultural cues which define a contextual workable environment for the L2 learners; their value, however, lies in the extent to which the student can access and manipulate them efficiently. CALL/IVD offers an increased opportunity for interaction and active learner involvement in this respect.

At the most elementary application, a hand-held remote controller with a simple IVD player can be an efficient interactive teaching technique with appropriate L2 materials (Reese et al., 1988). Interfaced with purposefully designed CALL lessons, CALL/IVD allows the student to interact even more vicariously and realistically with video material (Rubin, 1984). Several large-scale CALL/IVD developmental projects are mentioned in the following section.

Macario, *Montevidisco* and *Interactive Dígame* are three CALL/IVD programs developed at Brigham Young University to teach Spanish to high school and university students. In validating their scope and content, Gale (1989) found that, compared with linear instruction using the same materials, students who studied via CALL/IVD scored higher on achievement measures and had more favorable attitudes toward the learning experience than those studying in a linear format.

Under development since 1985, the Annapolis Interactive Video Project (Rivera-La Scala, 1989) has produced a series of videodiscs from TV segments down-linked and recorded via satellite dish for instructional purposes. Several CALL/IVD lessons, each designed to match a specific unit goal, have been devised for the beginning Spanish curriculum at the U.S. Naval Academy. Initiatives are underway to compare the effectiveness of this CALL/IVD versus non-CALL/IVD instruction.

The Language Learning Disc (LLD) (Rubin, 1989) is designed to help adult English speakers learn how to learn a second language through strategy training focusing on the process aspect of language learning. The material has been pilot tested at the Defense Language Institute, however, to date no research data have been reported.

The Colloquial Korean Interactive Video Project, a joint effort of the National Cryptologic School and Brigham Young University (Kim, 1987) is designed to improve learners' listening comprehension skill in authentic natural Korean. The highly individualized program makes extensive use of computed-mediated help

options to allow maximum learner control of the program while accommodating individual differences within learners.

The Athena Language Learning Project (ALLP) at MIT (Murray et al., 1989; Morganstern, 1986) incorporates interactive audio, IVD and artificial intelligence protocols to create courseware for a four course sequence each in Spanish, French, German, and ESL. At specially designed workstations, students practice problem solving via the IVD lessons as they develop competence in the functional language of everyday communication. This learning is then reinforced through classroom small-group activities.

In addition to the aforementioned large-scale developmental projects, several studies using CALL/IVD have also been conducted at the US Air Force Academy to examine the effectiveness of this instructional medium. Schrupp et al. (1983) reported statistically superior achievement and retention of content among cadets using interactive CALL/IVD for beginning German over others using the same video (*Klavier en Haus*) in linear format. Crotty (1984) demonstrated superior outcomes among cadets learning vocabulary and grammar via linear or interactive video in beginning French using contents from the Academy's Seven Language Disc. Verano (1987) found that segmented (purposefully interrupted) CALL/IVD is better than linear presentation of *Zarabanda* lessons without comprehension checks in fostering achievement and retention in beginning Spanish, but that fully interactive CALL/IVD material (i.e. that which incorporates replay, help options and corroborative reinforcement) is significantly the best CALL/IVD presentation device of all. Marks (1989) using *Dos Mundos* materials presented data on the value of video contextual clues delivered by CALL/IVD in facilitating learner's listening comprehension for beginning Spanish.

The following section reviews cooperative CAI and CALL learning vis a vis efficient use of the IVD workstation.

Cooperative CAI and CALL

The popularity of computers in educational settings has led some researchers to voice concern that learner isolation in typical CAI workstations may have a deleterious effect on learning and the learner's prosocial development owing to (1) a lack of opportunity for students to summarize orally and explain what is being learned, (2) an absence of peer models to demonstrate alternate learning strategies, (3) the loneliness or frustration of working alone, and (4) the reduced opportunity for peer social reinforcement and encouragement during learning (Johnson and Johnson, 1986). These same researchers recommend cooperative arrangements at the CAI workstation proper as a means of attending to the social aspects of learning. On the practical side, shared workstation use can increase the learner's access to CAI/CALL materials while reducing the hardware constraints faced by schools with restricted budgets. Recent CAI studies which may bear on workstation usage protocols for CALL are summarized below.

Johnson et al. (1985, 1986) found that cooperative CAI accounted for greater quantity and quality of achievement in map reading among junior high students and promoted more successful factual recognition and problem solving and positive attitudes towards the medium than studying alone at the computer. Carrier and Sales (1987) noted that students working in pairs on CAI tasks (acquisition of concepts) more often than "loners" opted for elaborate over simple feedback and, further, that interaction patterns between users at the workstation vary considerably according to sex differences. In their study, female pairs were found to verbalize most during CAI tasks. Male-female pairs demonstrated the greatest amount of off-task behavior. This off-task behavior accounted for nearly one quarter of all conversation during the learning task. As for learning outcomes, Carrier and Sales found that students working alone or in pairs achieved equally well on posttest measures. Guntermann and Tovar (1987) also found equal standards of achievement and productivity among preteen CAI students learning LOGO alone, in pairs or in triads. The researchers also noted that gender differences within pairs effected the character and quality of information exchange during the CAI lessons. Females tended to reflect more agreement and males displayed more solidarity and were more antagonistic towards one another.

Mevarech et al. (1987) reported that paired junior-high students studying Hebrew via CAI achieved significantly better in grammar and vocabulary than classmates studying alone at the computer. The dyads also showed significantly more positive attitudes towards their peers at the end of the CAI lessons. Trowbridge and

Durnin (1984) reported equal achievement among students studying concepts from science education alone, or with partners. The interaction within dyads, triads, and quads at CAI workstations was greater and benefited dyads the most, triads and quads the least, in that order. In the latter group, the least interactive member participated significantly less than his or her "teammates" in problem solving and had lower scores on achievement suggesting the need to "task" each member of a group with specific responsibilities (recording, reporting, etc.) to carry forth while working with others at the CAI workstation. Okey and Majer (1976) found equal achievement but significant differences in completion time among undergraduate teacher candidates in science education who studied via CAI workstations alone, in dyads, triads or quads. Students in groups of three or four used significantly less time than did those who studied alone or in pairs. Hooper and Hannafin (1988) found that low-ability students paired with high-ability learners for CAI tutorials in arithmetic scored higher on tests than their counterparts paired homogeneously, and that the high ability student's test performance was not compromised when paired with a lower-ability student.

Elsewhere, in the field of language education, Piper (1986) observed that college EFL students typically do not interact with one another during CALL lessons (or thereafter) unless the lessons themselves incorporate or foster strategies to suggest interaction and/or require cooperation, consultation or negotiation to complete the learning task. In the same vein, Young (1988) found a richer, and more spontaneous conversational discourse and less reading aloud from the screen within pairs and groups of up to five students using CALL for ESL learners when the lesson format reflected simulation and adventure games allowing negotiable outcomes. Mydlarski (1987) observed the qualitative aspect of interaction in pairs using CALL material for students of French as a second language and found that the typical interaction focused more on procedure than on the content of the presented CALL lessons.

Chang (1989) demonstrated that cadets at the Air Force Academy studying in pairs at CALL/IVD workstations achieved as well as students following CALL/IVD lessons by themselves, but that the former were more able in answering implicit questions put to them about the *Zarabanda* lesson content for beginning Spanish. Attitude towards the materials and CALL/IVD were also more positive for paired students. Chang further noted a post-experimental preference of all students in her experimental population for paired (cooperative) learning environment.

Conclusion

The various findings reported herein substantiate the strength of CAI/IVD as a viable instructional medium and point to the positive effects of cooperative CAI/CALL learning as an instructional strategy; they further suggest that a combination of CAI/IVD materials for L2 along with cooperative learning strategies may provide advantages that enhance student achievement and attitudes towards L2 learning in general.

These studies also imply that the CALL/IVD workstation configured to accommodate more than a single learner offers savings from several points of view: (1) the time needed for students to reach criterion performance is typically reduced, and (2) the budget required to equip a modern CALL/IVD laboratory is potentially reduced by half.

Finally, how the pairs, triads and larger groups are constituted and tasked is equally important in terms of expected student-student and student-workstation dynamics, learner satisfaction and attention to task. Strategy training may help to control some interaction patterns between sexes that in some studies reviewed above augured against task-specific CAI behavior. In any event, the efficient use of the CALL/IVD workstation vis a vis pair strategy, makeup or small group structure is still open to further refinement and creativity.

References

- Ahmad, K., Corbett, G., Rogers, M., & Sussex, R. (1985). *Computers, Language Learning and Language Teaching*. London: Cambridge University Press.
- Ariew, R. (1987). Integrating video and call in the curriculum: The role of the actfl guidelines. In Wm. Flint Smith (Ed.), *Modern Media in Foreign Language Education: Theory and Implementation*. (pp. 41-66). Lincolnwood: National Textbook Company.
- Ausubel, D. P. (1963). *The Psychology of Meaningful Verbal Learning*. New York: Grune and Stratton.
- Blake, R. (1987). CALL and the language lab of the future. *ADFL Bulletin* 18, (2), 25-29.
- Bunderson, C. V., Olsen, J. B. & Baillio, B. (1981). *Proof-of-Concept Demonstration and Comparative Evaluation of a Prototype Intelligent Videodisc System*. Oram, UT: WICAT, Inc. . [EDRS: ED 228 989].
- Bush, M. D. & Crotty, J. (1989). Interactive videodisc in language teaching. In Wm. Flint Smith (Ed.), *Modern Technology in Foreign Language Education: Applications and Projects* (pp. 75-95). Lincolnwood, IL: National Textbook Company, .
- Carrier, C. A., & Sales, G. C. (1987). Pair versus individual work on the acquisition of concepts in a computer-based instructional lesson. *Journal of Computer-Based Instruction* 14, 11-17.
- Chang, K-Y. R. (1989). *The Interaction of Cooperative Learning and Computer-Mediated Interactive Videodisc Instruction in Beginning Spanish*. Unpublished Doctoral. Dissertation, Purdue University.
- Crotty, J. (1984) *Instruction Via an Intelligent Videodisc System versus Classroom Instruction for Beginning College French Students: A Comparative Experiment*. Unpublished Doctoral. Dissertation, University of Kansas.
- Curtin, C. O., & Shinall, S. L. (1987). Teacher training for CALL and its implications. In Wm. Flint Smith, (Ed.), *Modern Media in Foreign Language Education: Theory and Implementation* (pp. 255-285). Lincolnwood, IL: National Textbook Company, .
- Dalton, D. W., & Hannafin, M. (1985). The effects of computer-assisted instruction on the self-esteem and achievement of remedial junior high school students: an exploratory study. *Association for Educational Data Systems Journal* 18 (3), 172-182.
- Dandonoli, P. (1989). The ACTFL computerized adaptive test of foreign language reading proficiency. In Wm. Flint Smith (Ed.), *Modern Technology in Foreign Language Education: Applications and Projects* (pp. 291-300). Lincolnwood: National Textbook Company, .
- Davies, N. F. & Omberg, M. (1987). Peer group teaching and the composition class. *System*, 15 (3), 313-23.
- Ebner, D. G., Danaher, B. G., Mahoney, J. V., Lippert, H. T. & Balson, P. M. (1984a). Current issues in interactive videodisc and computer-based instruction. *Instructional Innovator*, 29, (3), 24-29.
- Ebner, D. G., Manning, D., Brooks, F., Mahoney, J., Lippert, H., & Balson, P.(1984b). Videodiscs can improve instructional efficiency. *Instructional Innovator*, 29, (6), 26-28.
- Edwards K. J., Devries, D. L. & Snyder, J. P.(1972). Games and teams. *Simulation and Games*, 3, 247-269.
- Eisenberg, Y. (1986). The effects of computer-based instruction on college students' interest and achievement, *Educational Technology* 26, (4), 40-43.
- Evelyn-Ng, K. L. & Olivier, W. P.(1987). Computer assisted language learning: an investigation on some design and implementation issues. *System*, 15, (1), 1-17.
- Fraser, S. C., Beaman, A., Diener, E., & Kelem, R. T.(1977). Two, three, or four heads are better than one: modification of college performance by peer monitoring. *Journal of Educational Psychology* 69, (2), 101-108.

- Gale, L. E. (1989). Macario, Montevideo, and Interactive DÍgame: Developing interactive video for language instruction. In Wm. Flint Smith (Ed.), *Modern Technology in Foreign Language Education: Applications and Projects* (pp. 235-248). Lincolnwood, IL: National Textbook Company.
- Garrett, C. B. (1988). Computers in foreign language education: teaching, learning, and language-acquisition research. *ADFL Bulletin* 19, (3), 6-12.
- Gunderson, B. & Johnson, D. (1980). Building positive attitudes by using cooperative learning groups. *Foreign Language Annals* 13, (1), 39-43.
- Guntermann, E., & Tovar, M. (1987). Collaborative problem-solving with LOGO: Effects of group size and group composition. *Journal of Educational Computing Research* 3, (3), 313-334.
- Hartl, C. (1984). *Cooperation: Student Pairs as a Catalyst for Learning Spanish*. Unpublished Doctoral Dissertation, Purdue University.
- Hedlund, D. E., & Casolara, W. M. (1986). Student reactions to the use of computerized experiments in introductory psychology. *Educational Technology* 26, (3), 42-45.
- Henderson, R. W., Landersman, E. M., & Kachuck, I. (1985). Computer-video instruction in mathematics: field test of an interactive approach. *Journal for Research in Mathematics Education* 16, (3), 207-224.
- Hooper, S., & Hannafin, M. J. (1988). Cooperative CBI: The effects of heterogeneous versus homogeneous grouping on the learning of progressively complex concepts. *Journal of Educational Computing Research* 4, (4), 413-424.
- Hope, G., Taylor, H. & Pusack, J. (1984). Using computers in teaching foreign languages. *Language and Education: Theory and Practice*, No. 57. Orlando, FL: Harcourt Brace Jovanovich, .
- Hubbard, P. L. (1987). Language teaching approaches, the evaluation of CALL software, and design implications. In Wm. Flint Smith (Ed.), *Modern Media in Foreign Language Education: Theory and Implementation* (pp. 227-254). Lincolnwood, IL: National Textbook Company.
- Johnson, D. W., Maruyama, G., Johnson, R., Nelson, D., & Skon, L. (1981). Effects of cooperative, competitive and individualistic goal structures on achievement: A meta-analysis. *Psychological Bulletin* 89, 47-62.
- Johnson, D. W., & Johnson, R. T. (1986). Computer-assisted cooperative learning. *Educational Technology* 26, (1), 12-18.
- Johnson, D. W., R. T. Johnson, Johnson, J., & Anderson, D. (1976). Effects of cooperation versus individualized instruction on students prosocial behavior, attitudes toward learning, and achievement. *Journal of Educational Psychology* 68, (4), 446-452.
- Johnson, R. T., Johnson, D. W., & Stanne, M. B. (1985). Effects of cooperative, competitive, and individualistic goal structures on computer-assisted instruction. *Journal of Educational Psychology* 77, (6), 668-677.
- Johnson, R. T., Johnson, D. W., & Stanne, M. B. (1986). Comparison of computer-assisted cooperative, competitive, and individualistic learning. *American Educational Research Journal* 23, (3), 382-392.
- Kim, W-C. M. (1987). The colloquial Korean interactive videodisc project. *CALICO Journal* 4, (4), 71-81.
- Kramsch, C. J. (1983). Interaction in the classroom: Learning to negotiate roles and meanings. *Unterrichtspraxis* 15-16, (2), 175-190.
- Kulik, C. C., Kulik, J. A., & Shwalb, B. J. (1986). The effectiveness of computer-based adult education. *Journal of Educational Computing Research* 2, (2), 135-252.

- Larson, J. W. (1989). S-CAPE: A Spanish computerized adaptive placement exam. In Wm. Flint Smith (Ed.), *Modern Technology in Foreign Language Education: Applications and Projects* (pp. 277-289). Lincolnwood, IL: National Textbook Company.
- Long, M. H., Porter, P. A. (1985). Group work, interlanguage talk, and second language acquisition. *TESOL Quarterly* 19, (2), 207-228.
- Malamah-Thomas, A. (1987). *Classroom Interaction*. New York, N.Y.: Oxford University Press.
- Marks, M. A. (1989). *Video Contextual Clues in Listening Comprehension for Beginning Spanish Students*. Paper presented at CALICO Symposium, Colorado Springs, CO.
- Mesch, D., Lew, M., Johnson, D. W., & Johnson, R. (1986). Isolated teenagers, cooperative learning, and the training of social skills. *The Journal of Psychology* 120, (4), 323-334.
- Mevarech, Z. R., Stern, D., & Levita, I. (1987). To cooperate or not to cooperate in CAI: That is the question. *Journal of Educational Research* 80, 164-167.
- Morgenstern, D. (1986). The Athena language learning project. *Hispania* 69, 740-745.
- Murray, J. H., Morgenstern, D., & Furstenberg, G. (1989). The Athena language-learning project: Design issues for the next generation of computer-based language-learning tools. In Wm. Flint Smith (Ed.), *Modern Technology in Foreign Language Education: Applications and Projects* (pp. 97-118). Lincolnwood, IL: National Textbook Company.
- Mydlarski, D. (1987). Cooperative computer-assisted language learning: is it living up to its promise? *Journal of Educational Techniques and Technologies* 20, (1), 26-29.
- Okey, J. R., & Majer, K. (1976). Individual and small-group learning with computer-assisted instruction. *AV Communication Review* 24, (1), 79-86.
- Olsen, S. (1980). Foreign language departments and computer-assisted instruction: a survey. *The Modern Language Journal* 64, (3), 341-49.
- Omaggio, A. C. (1986). *Teaching Language in Context*. Boston, MA: Heinle and Heinle.
- Pederson, K. M. (1987). Research on CALL. In Wm. Flint Smith (Ed.), *Modern Media in Foreign Language Education: Theory and Implementation* (pp. 99-131). Lincolnwood, IL: National Textbook Company.
- Pica, T. & Doughty, C. (1985). The role of group work in classroom second language acquisition. *Studies in Second Language Acquisition* 7, (2), 233-248.
- Piper, A. (1986). Conversation and the computer: A study of conversational spin-off generated among learners of English as a foreign language working in groups. *System*, 14, (2), 187-198.
- Reese, L. G., Eastmond, J. N. Jr., & Sutherland, R. (1988). Integrated use of videodisc for intensive Spanish language learning. *CALICO Journal* 6, (1), 69-81.
- Rivera-La Scala, G. M. (1989). The Annapolis interactive video project. In Wm. Flint Smith (Ed.), *Modern Technology in Foreign Language Education: Applications and Projects* (pp. 257-261). Lincolnwood, IL: National Textbook Company.
- Rivers, W. M. (1987). *Interactive Teaching*. New York, N.Y.: Cambridge University Press.
- Rubin, J. (1984). Using the educational potential of videodisc in language learning. *CALICO Journal* 1, (4), 31-34.
- Rubin, J. (1989). LLD: The language learning disc. In Wm. Flint Smith (Ed.), *Modern Technology in Foreign Language Education: Applications and Projects* (pp. 269-275). Lincolnwood, IL: National Textbook Company.

- Schrupp, D. M., Bush, M. D. & Mueller, G. A. (1983). 'Klavier im Haus'--An interactive experiment in foreign language instruction. *CALICO Journal* 1, (2), 17-21.
- Seliger, H. W. (1983). Learner interaction in the classroom and its effects on language acquisition. In H. W. Seliger & M. H. Long (Eds.), *Classroom Oriented Research in Second Language Acquisition* (pp. 246-267). Rowley, MA: Newbury House.
- Sharan, S., Kussell, P., Hertz-Lazarowitz, R., Bejarano, Y., Raviv, S., & Sharan, Y. (1984). *Cooperative Learning in the Classroom: Research in Desegregated Schools*. Hillsdale, New Jersey: Lawrence Erlbaum Associates, Publisher.
- Sharan, S., & Sharan, Y. (1976). *Small Group Teaching*. New Jersey: Educational Technology Publications.
- Slavin, R. E. (1980). Cooperative learning in teams: State of the art. *Educational Psychologist* 15, (2), 93-111.
- Smith, W. F. (Ed.). (1987). *Modern Media in Foreign Language Education: Theory and Implementation*. The ACTFL Foreign Language Education Series. Lincolnwood, IL: National Textbook Company.
- Smith, W. F. (Ed.). (1989). *Modern Technology in Foreign Language Education: Applications and Projects*. The ACTFL Foreign Language Education Series. Lincolnwood, IL: National Textbook Company.
- Trowbridge, D., & Durnin, R. (1984). *Results From an Investigation of Groups Working at The Computer*. Washington, D.C.: National Science Foundation [EDRS: ED 238 724.].
- Underwood, J. (1984). *Linguistics, Computers, and the Language Teacher: A Communicative Approach*. Rowley, MA: Newbury House.
- Verano, M. (1987). *Achievement and Retention in Spanish Presented Via Videodisc in Linear, Segmented, and Interactive Modes*. Unpublished Doctoral Dissertation, University of Texas.
- Wyatt, D. H. (1983). *Computer-Assisted Learning in ESL*. Washington, DC: Center for Applied Linguistics.
- Young, R. (1988). Computer-assisted language learning conversations: negotiating an outcome. *CALICO Journal* 5, (3), 65-83.
- Yuker, H. E. (1955). Group atmosphere and memory. *Journal of Abnormal and Social Psychology* 51, 17-23.

From Interactive Videodisc to CD-XXX: The Future

Michael D. Bush

United States Air Force Academy

Introduction

There are two crucial questions faced by pioneers who seek to implement interactive videodisc (IVD) in second language learning. The most important of the two is, "What should one do with the technology?" Or in other words, "What problem can it solve?" This question focuses the user on the needs that have to be addressed rather than on the technology to be used. Nevertheless, the second issue of delivery systems is extremely important: hardware must be purchased and software must be created.

Although the focus of this article is on how to get the instructional material to the learner, the basic guiding premise is to keep in mind what the technology should be doing. Valid principles that help us to understand the instructional problem are valid no matter the delivery system, and if future platforms are cheaper or more powerful than those in use today, the question then becomes, "How should one plan for future platforms in a way that takes maximum advantage of current ones and prepares for those to come?"

Despite the fact that this volume of articles is about interactive videodisc, videodisc technology will not make the marvels of interactivity available to large numbers of people. That accomplishment will belong to the technology or technologies of the mass marketplace where low costs associated with the manufacturing economies of scale are possible, making delivery systems affordable. Nevertheless, the accomplishments of the future are grounded in current capabilities, and because videodisc is today's mature interactive technology, it must appear at the beginning of any discussion.

Given the current importance of interactive videodisc, we will first examine a few basic ideas to provide a theoretical basis for its use. The balance of the discussion will focus on technologies that will in the future most likely have the potential to provide a similar level of functionality at lower cost.

The Value of Interactive Videodisc

Interactive videodisc has captured the imaginations of language teachers and learners alike for the past ten years. Seeing and hearing "real people" speak "real language" is an extremely compelling and motivational experience for language learners. Furthermore, there is evidence that the inclusion of the visual element in the learning process actually improves learning outcome.

Greenfield in her book, *Mind and Media* (1984) cites research in a field other than language learning that was conducted by her and others (Beagles-Roos and Greenfield, 1982; and Beagles-Roos and Gat, 1983) in which it was learned that the addition of dynamic visual images makes verbally presented information easier to remember.

Increasingly clear is the fact that learning languages is not a simple matter of learning content: being able to recite grammar rules and perform well on vocabulary tests does not ensure the ability to understand language in context. The process of learning itself seems to be perhaps even more important than the content that is learned. Schank (1990) discusses how knowledge itself is closely intertwined with story-telling and reminding, both very obviously related to experience. This is important because one of the strengths of interactive videodisc is the facility it provides the user to vicariously experience stories at a level that matches their ability to comprehend.

Authenticity, motivation, vicarious experiences, story-telling, and memory structures are all concepts that transcend any particular communications medium. Moreover, videodisc has been shown to have the potential to incorporate each of the elements in the learning experience. Due to cost, however, videodisc has been largely confined to specialized sectors such as military and industrial training.

The challenge, therefore, is to provide functionality similar to that of interactive videodisc at the lowest possible cost. The microcomputer industry's interest in multimedia technology, combined with compact disc technology, seem to form a combination that has the potential to meet the challenge.

Beyond Videodisc: Digital Makes Sense

Multimedia and compact disc technology are important aspects of the digital systems revolution that is a significant part of the Information Age into which the world is currently moving. Anyone who reads Gilder's *Microcosm* (1989) is obliged to become keenly aware of the advances (read greater power at lower costs) yet to come from silicon-based, digital systems.

I was first alerted to this notion as I stood on the periphery of a discussion with Bill Gates (the Chairman of Microsoft and a key founder of the microcomputer revolution) at Microsoft's First International Conference on CD-ROM. Gates was assailed by a group of long-time videodisc developers who demanded to know how he could so enthusiastically support a technology that was so obviously inferior to the one they knew so well. "You don't have the bandwidth," they went on, meaning that the data transfer rate from compact disc is too slow to support full motion video. Gates, totally unfazed, advised them not to worry because the long-term advantages of having all information in digital form would be fully realized in the not-too-distant future, as memory prices dropped and as processor speeds increased. "You can do so much with video that is in digital form", he told them. [emphasis added]

With this enthusiasm for digital technology, Gates has become a leader in the microcomputer industry's movement toward the implementation of compact disc technology and "multimedia." The mass-market potential of these developments promises to bring not only the power of interactive videodisc but also the price reductions that will make wide-scale implementation possible.

Toward a Transition Path

If digital systems are going to be the systems of the future, why then is interactive videodisc an important technology for language education today? The answer is two-fold. First, videodisc is the technology that can make interactivity available today. Second, new technologies are always influenced by the old and to best use the new, it is critical to know the strengths and weaknesses of the old. Technological innovation in all areas follows a pattern that is predictable by its exploitation of the strengths of current systems before the move to the capabilities of the future.

For example, knowledgeable people in the computer industry know today that 16 megabit memory chips will soon be possible. Yet the smaller capacity 256 kilobit, 1 megabit, and 4 megabit chips enjoy a lot of attention in the marketplace into the foreseeable future. This is a reflection of the principle that price as well as performance must be considered when making technology decisions. In the consumer electronics industry, developments often exist in the laboratories of companies long before they are made available to the public for purchase.

There are at least a couple of reasons for this pattern. First, developers must re-coup their investment in each technology before moving on to the next generation. The second reason is that the possibilities of current technologies must be understood before new uses can be imagined for future ones.

To create a proper transition path from the present to the future requires that materials developers (1) learn lessons from current technologies, (2) understand the potential of new technologies, (3) synthesize this information in a way to improve materials development efforts. Putting some good thought into developing materials for interactive videodisc will likely make all or most of the content useable on the newer systems.

In the following sections we will take a quick look at the capabilities of both videodisc and digital technologies. The discussion of digital systems will focus on compact disc for two main reasons. First, the microcomputer and consumer electronics marketplaces are showing serious interest in compact disc. As sales increase in these arenas, prices will drop for education and training. As interactive technology becomes more mainstream, these two market segments will no longer have to rely on what has been essentially a very specialized technology (interactive videodisc), interesting to only these two small segments of the overall marketplace. Second, it is important to understand whether compact disc might have the potential to displace videodisc as the

primary interactive learning technology. An analysis and determination of the potential in this area becomes possible upon assessment of the strengths and weaknesses of both of the technologies.

Interactive Videodisc: Overview and Lessons Learned

Looking at the topics covered in computer magazines over the past couple of years reveals that the digital world of microcomputers is caught up in the new concept of "multimedia." Given the excitement that surrounds this new technology, it is not difficult to miss the fact that interactive videodisc is the most mature multimedia technology available today. Despite the fact that videodisc has had the narrow attention of a few people in education and a few in military and industrial training, the similarities between the two technologies becomes apparent when considering a fairly straightforward definition of multimedia:

Multimedia is the interactive and potentially simultaneous presentation of visual and auditory data for the purpose of obtaining entertainment or learning.

Although interactive videodisc fits this definition quite handily, few individuals in the multimedia arena have had enough experience with this technology to recognize its importance. Indeed, Steve Jobs, one of the founders of Apple Computer has been quoted as telling educators that "interactive videodisc will go nowhere!" The reason he gave was that videodisc "lacks adequate resolution."

Videodisc became a commercially viable technology in the mid to late 1970's and caught the attention of education and training people in the early 1980's. It is based on the same analog television technology that dates from the 1920's and 30's and was updated in the United States in the early 1950's to today's NTSC¹ color standard. The age of TV technology saddles the interactive technology with the low resolution Steve Jobs has criticized. This low resolution is acceptable on our TV screens because a lot of different colors are possible at each pixel², a feature of the fact that the colors are represented by varying voltages that can have several million values over a small voltage range³ yielding of course several million colors. The ability to handle this large number of colors as well as the capability to put 30 images a second on the screen using the air waves or cable is a good way to explain the reasonably high bandwidth that has made TV technology as successful as it has been.⁴

To make interactive videodisc possible, developers devised the means to take each one of those images and encode it on single track on the reflective surface of a disc. The optics and laser system that reads the data is able to focus very finely, making possible the placement of 54,000 concentric circles or tracks on one side of the type of disc that is useful for creating interactive applications.⁵ Each track represents one image, so placing the tracking mechanism under computer control enables the controlling software to move the user rapidly to any point on the disc, creating the interactive nature of the technology. Viewing these frames sequentially provides the viewer with one half-hour of video per videodisc side.

In our work over the past several years at the United States Air Force Academy we have learned quite a few important lessons about ways to take advantage of this interactivity. Perhaps the most important one is the understanding we are developing of just how much work must be done to address the interactive videodisc

¹National Television Standards Committee. A television industry group that determined the color television standard used in the United States today.

²Picture Element: the individual "spots" on the face of the television that make up the image. Television has about 320 pixels across the screen and about 200 pixels down. Typical color computer monitors today display 640x480 pixels but significantly fewer colors than is possible with television.

³We live in an "analog" world in which colors are of an infinite number of hues and light has an infinite number of shades of lightness or darkness. For the digital world this variety of possibilities must be reduced to light or dark, off or on, represented in the computer by 1's and 0's.

⁴Bandwidth is the capacity to transfer data from one place to another. By its analog nature, television is able to provide a good quality picture because it can capture a lot of visual data at the camera at the transmission site and deliver it to the receiver.

⁵This is the definition of Constant Angular Velocity (CAV) videodisc, the one that really makes interactivity possible. The other technology, Constant Linear Velocity (CLV), records the images in a spiral rather than tracks, must be accessed using a time counter, and cannot normally display a still frame.

materials availability problem. It is clear to us that some huge efforts will be necessary to provide the quantity of materials required to support a cross-section of any size of the language courses taught today.

Although we have hundreds of students using hundreds of interactive videodisc lessons daily, we are continually impressed with the notion that our efforts are only a few drops in the proverbial bucket. This constitutes an interesting parallel to the task that university professors must have faced in the late 1400's, following Gutenberg's invention of movable type for the Western World. Some of them must have been aware of the benefit that relatively cheap text books would provide to their students and to the learning process. The only problem was that they had to write them -- from scratch.

Developing interactive materials from scratch is an extremely complex task that must be addressed on the one hand by institutions and organizations working together and on the other by the creation of a mass market over which development costs can be spread. This brings the discussion to compact disc. Although its interactive component is not yet well-known to the buying public, it is the technology that is closest to something that the buying public can understand and perhaps embrace.

Compact Disc Technologies: Overview

The first compact disc technology to become available was Compact Disc Audio (CD Audio). It first appeared for sale in 1980-81 and uses essentially the same optical reflective system as videodisc but records digital information on the disc rather than an analog TV signal like videodisc. In addition, it uses a spiral on the disc rather than concentric circles as does the interactive (CAV) form of videodisc. The audio quality from CD is exceptional, causing this technology to surpass in sales all other forms of audio materials distribution such as cassettes and black vinyl records. The speed with which it has accomplished this has surprised even its creators at Philips, the Dutch company, and at Sony of Japan. No one there ever imagined the technology would be accepted in the marketplace.

By definition, this is an audio technology and is therefore of limited use in other areas. Because the data stored on the disc is digital, however, it quickly became apparent that the underlying technology might be useful in other areas.

This brought about the creation of the technology that has caught the attention of the microcomputer industry, Compact Disc-Read Only Memory (CD-ROM). First gaining public attention at Microsoft's First International CD-ROM Conference in the Spring of 1986, this technology basically adds a digital data component to the digital audio that was already a part of its predecessor.

This meant that text, graphics, and even compressed audio in extremely large quantities (550 to 650 megabytes of data) could be placed on compact disc for distribution.⁶ To better understand what this means, it is useful to translate this into real-world terms: 650 megabytes equates to 1,800 standard floppy disks (at 360KB each) or almost 300,000 typed pages of information.

The limitations of this first computer application of compact disc technology were numerous and hindered the its acceptance. Not only was there no standard way to encode graphics and audio for distribution using the technology, but also many potential users seemed to want motion video as well.

At the same Microsoft conference mentioned above, Philips and Sony announced Compact Disc-Interactive (CD-I), a consumer technology that addressed the audio and graphics standards issues. They were joined by other Japanese, American, and European companies in what they all still hope will become a world consumer electronics standard as has happened for CD-Audio. CD-I, as announced, had all of the capabilities of CD-Audio and CD-ROM but lacked motion video, a limitation that has since been remedied.⁷ Additional problems that have

⁶Many have criticized CD-ROM for its inability to accept data recorded by users. The term "writeable CD-ROM" is an oxymoron and diverts attention from the real value of CD-ROM: the ability to distribute large quantities of information cheaply to lots of people.

⁷It was this lack of motion video that Bill Gates was addressing in the discussion mentioned earlier. In that conversation the videodisc developers were saying that the data transfer rate (bandwidth) of CD-ROM (150,000 bytes per second) was insufficient to permit the display of video on the screen.

limited its implementation are its requirement for specialized and proprietary hardware and software. This situation has created tremendous and costly materials development problems.

At Microsoft's Second Annual International CD-ROM Conference in the Spring of 1987, RCA⁸ announced Digital Video Interactive (DVI), also a follow-on to CD-ROM and CD-Audio and a potential competitor to CD-I. During the industry announcements session of the conference when the engineers from RCA demonstrated full-screen video from compact disc, the large conference hall erupted in a standing ovation. It was not clear if the enthusiasm resulted from the fact that the technology was of American origin or if people were just glad to see full motion video from compact disc. In any case, digital video was possible, solving one of the major perceived limitations of CD-I.

Although its visual quality has improved since its announcement, DVI's initial pictures were not as good as the images from VHS videocassettes. When I commented on this during a closer examination, the engineer at my side said, "There ain't no free lunch!" He was alluding to the fact that to conform to the bandwidth of compact disc technology, the digital images had to be compressed⁹ and de-compressed for display. The "fuzzy image problem" constituted one of the main drawbacks of that generation DVI technology. Also, the materials development process is extremely complex. One aspect of the problem is the compression process for the video, currently a very computer-intensive and expensive process.

On the positive side, the computer industry has pledged significant support for DVI technology. Supporters include Intel, Microsoft, IBM, Lotus, and others. One of its strengths is technical: the basic hardware is re-programmable "on the fly." This gives it the ability to conform to additional compression algorithms as they become available, a marked contrast with CD-I. Also, if one complete side of a disc is used for the motion data, it can provide 73 minutes of full-screen, full-motion video.

As a bridge between the computer industry and the compact disc world, Sony and Philips announced CD-ROM Extended Architecture (CD-ROM XA) in August, 1988. It has all of the capabilities of CD-ROM and, in addition, uses the audio and graphics standards of CD-I: elements that DVI proponents have pledged to support. Using CD-I's C-level audio, it is possible to place over 16 hours of very good quality audio on one disc and still be able to have over 300 megabytes of data as well. In addition, it is possible to implement limited, "postage stamp" video with accompanied audio.¹⁰

Technology Conclusions

As is evident, interactive videodisc is the oldest, interactive audiovisual technology available today. At the Air Force Academy we have concluded, some ten years into the life of this technology, that we are only now getting a handle on how to best create interactive videodisc materials. Indeed, it can be said that IVD developers now have tools that allow them easy access to the 54,000 frames of information contained on one videodisc side. In contrast, the compact disc industry is faced with finding efficient ways to address the difficulties of handling hundreds or even thousands of digital data files involved with implementing compact disc technology. While IVD

⁸RCA developed DVI at its Sarnoff Laboratory in Princeton, NJ. Later, General Electric purchased this operation, eventually selling the technology to Intel. One of Intel's partners in this venture has been IBM, which along with Microsoft has been one of the main proponents of DVI technology.

⁹To better understand this issue it is necessary to return to the question of how television technology. TV puts a lot of little colored dots (pixels) on the screen to form the image, and its analog technology does a good job representing a lot of colors at each pixel. To represent varying degrees of anything in the digital world, however, requires several "binary digits" (bits). For example, a typical single color television image requires a very large number of bits for its digital representation: 512,000 bits for a single, 256-color image. At the resolution of television (320x200) this amounts to a picture quality that many find unacceptable. Furthermore, without compressing the data, it is impossible to display 30 of these images a second to get full-screen, full-motion video. This amounts to a requirement of transferring 15 megabits per second and CD-ROM can deliver only 1.2 megabits per second.

¹⁰Synchronizing the audio with the video is a technical problem of not insignificant proportions. In CD-ROM XA, the audio and other data are "interleaved" into a single data stream before placement on the disc. This enables audio to be playing while the other data are being loaded into the computer. It requires, however, that the audio data be adjacent to the appropriate graphics data, otherwise a speaker's lips do not move with the words being spoken. This synchronization issue is one of capabilities that is automatic with television and thus videodisc.

developers have had several years to create useful tools, the first tools for digital information manipulation are only now becoming available.

The fact that producing materials for all-digital delivery systems is an extremely complex process was confirmed in a recent study in which researchers conducted a survey of ten developers for DVI. Most of those surveyed had previous IVD experience and reported the DVI applications development process to be quite difficult (Lidard and Hix, 1990). A similar situation is reported by developers working on applications for Compact Disc Interactive (CD-I) (Fritz, 1990).

That is the negative side. The positive side is that the huge amount of interest that will most likely be enjoyed by compact disc technologies in the consumer and microcomputer marketplaces should provide a financial base that will help absorb the tremendous costs that will have to be incurred for materials development. Also, as the technology develops further, more powerful tools will be developed that will reduce costs even further.

Summary

In this discussion we have examined interactive videodisc as the mature delivery system available today, a system with limitations, but nevertheless one that has been used by foreign language educators for roughly ten years now. Lessons learned during these first years will be extremely useful during the transition to new instructional delivery platforms.

We have also looked at characteristics of compact disc systems and how they will make the move from the category of interesting technologies to wide-scale implementation. Due to their increasing power and their dropping costs, it is clear that subsequent technologies will most likely make interactive videodisc obsolete. Because availability of any technology is ultimately determined by price as well as performance, it is self-evident that the cheapest, sufficiently powerful delivery system is the one that will be implemented on a broad scale, ultimately making interactivity available to more learners than would ordinarily be possible.

Understanding the strengths and weaknesses of compact disc technologies will increase the likelihood that they will be useful to educators as their prices drop. Crucial is the understanding that learning technology is important only through the types of things it allows the learner to accomplish. It is not clear that if these technologies were available and affordable, that the foreign language education community would be able yet to put them to good use.

Organizations that wish to implement today's technology must not do so without a plan for obsolescence and transition, taking into account not only the capabilities of today's platforms but also maintaining an awareness of the possibilities of future systems. They also need to study the interactive process itself to discover how learners use the technology, thereby gaining important knowledge that will significantly benefit future implementations.

Materials developers must focus on sound learning theory rather than on delivery systems and develop instructional strategies and software implementations that are as platform-independent and open-ended as possible. Those who focus on the materials and how learners use them today will learn lessons from current systems and thus be better prepared to take advantage of the capabilities of new technologies as they become available tomorrow.

References

- Beagles-Roos, J. and Greenfield, P. (1982). "Radio and television experimentally compared: Effects of the medium on imagination and transmission of content," final report to National Institute of Education, Teaching and Learning Program.
- Beagles-Roos, J. and Gat, I. (1983). "Specific impact of radio and television on children's story comprehension," *Journal of Educational Psychology*, 75, 128-137.
- Bush, M. D. and Crotty, J. (1988). "Interactive Videodisc in Foreign Language Education", In W. F. Smith (Ed.) *Modern Technology in Foreign Language Education: Applications and Projects*, The ACTFL Foreign Language Education Series, Lincoln, IL: National Textbook Company.
- Fritz, M. (1990) "Inside CD-I". *Data Training*, IX, 4, pp. 29-30, March 1990.
- Gilder, G. (1989). *Microcosm: The Quantum Revolution in Economics and Technology*. New York: Simon and Schuster.
- Greenfield, P. M. (1984) *Mind and Media*, Cambridge: Harvard University Press.
- Lidard, S and Hix, D. (1990) "Digital Video Interactive: What Multimedia Developers Think About It." *Virginia Tech DVI Project Research Project Report*. Funded by the NCR Corporation and the Virginia Center for Innovative Technology.
- Schank, R. C. (1990). *Tell Me A Story: A New Look at Real and Artificial Memory*. New York: Charles Scribner's Sons.

Glossary

ACCESS TIME: The longest time it takes to find, retrieve and display information.

ANALOG: Information which steadily flows and changes. Examples are time, temperature and voltage. The opposite of analog is digital.

ARTIFICIAL INTELLIGENCE (AI): Artificial intelligence is the study and application of what is known about human intelligent behavior to the development of machine (computer) systems that model intelligent behavior.

AUTHORING: A structured approach to developing all elements of an interactive videodisc program with emphasis on preproduction.

AUTHORING LANGUAGE: Programming language with codes specifically designed to handle major courseware needs such as response judging.

AUTHORING SYSTEM: Prepackaged courseware templates or menu-driven editors designed to help authors create courseware without elaborate programming.

BLACK BOX: Any intermediate piece of hardware used to link the computer with peripherals.

BLANKING: The time it takes for a videodisc to search from one sequence to another when the video image is turned off. This results in a "blank" screen, thus the search interval between sequences is referred to as "blanking".

BRANCH: An instruction to diverge from one sequence in a program to another; a sequence selected on the basis of a user response.

CAPACITANCE DISC: There are two types:

- | | |
|---------------------|----------------------------------|
| (1) RCA--groove | Both are contained in a specific |
| (2) VHD--grooveless | protective case or caddy. |

See RCA; VHD

CARD: An internal plug-in unit which holds the chips and wiring that control some of the function of the CPU or interface.

CBE: Computer-Based Education.

CBI: Computer-Based Instruction

CBIV: Computer-Based Interactive Video. The application of computer technology with either videodisc or video tape technology.

CBT: Computer-Based Training. Term used to describe instruction delivered by using a computer; includes computer-assisted or computer-managed instruction.

CED: Capacitance Electronic Disc developed and abandoned by RCA. See RCA.

CENTRAL PROCESSOR: A unit of a computer that includes the circuits controlling the interpretation and execution of instructions.

CHAPTER: A consecutive sequence of frames.

CHAPTER CODE/STOP: A code embedded in the vertical interval of the videodisc that enables certain videodisc players (mostly Level One reflective) to locate the beginning of chapters.

Glossary

- CHECK DISC:** A disc that is used to evaluate video material prior to the replication of release copies; similar in concept to an answer print in the motion picture industry.
- CMI:** Computer-Managed Instruction. Use of a computer to guide a student through an individualized instructional program.
- COGNITIVE STRATEGIES:** Those processes individuals use to learn new information, such as strategies to select, organize and integrate information.
- COMPRESSED AUDIO:** Sometimes called Still Frame Audio (SFA), compressed audio describes a method of digital encoding or analog compression of several seconds of voice quality audio per individual disc frame, resulting in a potential for several hours of audio per disc.
- CONSTANT ANGULAR VELOCITY (CAV):** A CAV laser disc revolves continuously at 1800 rpm, one frame per revolution; making each frame of a CAV disc addressable, a basic requirement for interactive videodiscs. Up to 30 minutes of video motion may be recorded on each side of a CAV laser disc.
- CONSTANT LINEAR VELOCITY (CLV):** A CLV or "extended play" laser disc maintains a consistent physical track length for each frame, thus enabling up to 60 minutes playing time per side, but sacrificing individual frame addressability. Reference to locations on CLV discs is limited to time in minutes and seconds. CLV discs are useless for interactive videodisc applications.
- COURSEWARE:** Computer-based curriculum materials. Contrasted with "hardware", which is the electromechanical equipment, and "software", which is the program for making the equipment perform in certain ways.
- CPU:** Central Processing Unit. See CENTRAL PROCESSOR.
- CUE:** Pulses entered onto one of the lines in the vertical blanking interval (VBI) that results in frame numbers, picture stops, chapter codes, closed captions, white flags, etc. on the disc.
- DATA BASE:** Collection of information, organized for retrieval. Generally, it is implied that this information is available in computer-readable form for either on-line or off-line access. However, some data bases which have been generated by a computer exist only in hard-copy form. An example may be the individual personnel records formed into a personnel data base.
- DATA FILE:** A collection of related records treated as a unit.
- DIGITAL:** Data which is generated or translated as a pattern of discrete, fixed values such as digits or other characters. Opposite of analog.
- DIGITAL DUMP:** A computer program that has been encoded onto a videodisc as a read-only memory (ROM) which in turn is loaded in a random access memory (RAM) resident in the videodisc player. The term "digital dump" is used in reference to Level Two videodiscs and players.
- DIRECT-READ-AFTER-WRITE (DRAW):** A record-once optical disc technology primarily used for mass storage of digital data.
- DISC, DISK, OR DISKETTE:** A flat circular plate made mainly of plastic used to record and replay information. It can be either analog or digital.
- DISK DRIVE:** A device consisting of a spindle on which a disk pack can be mounted for electronically storing data.
- DRILL AND PRACTICE:** An instructional program which focuses on the development of skills through repetition. It is generally mastery oriented. See GAME; SIMULATION; TUTORIAL.
- FEEDBACK:** Information given to learners to help them evaluate how well they are doing. It could consist of explicit knowledge of results following the answer to a question, or it could be the outcome of a decision made during a simulation. See REINFORCEMENT; REMEDIATION.

Glossary

FIELD: A scan of 262-1/2 lines on the screen at 1/60 of a second constituting one-half of a complete video frame for NTSC standard. See FRAME.

FIELD DOMINANCE: The determination of a consistent edit point (either field one or field two) on the videotape record and playback machines prior to beginning of a premastering session.

FIELD KICKING: Sometimes called "field search," "field ID," "field selection" or "field monitoring," field kicking is a method used by some capacitance videodisc systems that enables the stylus sensor to randomly access any one of four fields or four frames instantaneously. See INSTANT JUMP.

FLICKER: Sometimes known as "interfield jitter" or "jitter," flicker is a phenomenon that occurs in a videodisc freeze frame or still frame when both fields are not identical thus creating two different pictures alternating every 1/60 of a second.

FLOPPY DISK: An oxide-coated plastic disk 5-1/2 or 8 inches in diameter enclosed in a protective covering that can be used for magnetically storing data.

FLOWCHART: A design tool used to represent the structure of an interactive program. It should show all the elements involved in the program and their relationship to one another. The flowchart must communicate to the scriptwriter, producer and programmer in order for the final product to come together as an integrated whole.

FORMATIVE EVALUATION: An evaluation process which occurs as part of product development in order to gather information which will be used to revise the instructional materials prior to their general release. See SUMMATIVE EVALUATION.

FRAME: Two complete scans of the video screen at 1/30 of a second. A frame is composed of two fields (at 262-1/2 lines for NTSC standard) and a retrace. A single frame is a standard CAV videodisc reference point. There can be as many as 54,000 addressable frames on one side of a CAV videodisc.

FREEZE FRAME: A single frame from a motion sequence that is stopped.

FULL FRAME TIME CODE: Otherwise known as Non-Drop Frame Time Code, Full Frame Time Code is a standardized (Society of Motion Picture and Television Engineers--SMPTE) method of address coding a videotape. It gives an accurate frame count rather than an accurate clock time.

GAME: A highly interactive instructional program using some level of competition to assist in the transfer of previously learned knowledge to new skills. See DRILL AND PRACTICE; SIMULATION; TUTORIAL.

GENERIC DISC: A videodisc that serves as a generic data base, usually on a single subject, such as hematology or space exploration.

GOALS: General statements of purpose; what the instruction is to accomplish. See OBJECTIVES.

INSTANT JUMP: Similar in effect, but not technique, to a capacitance "field kicking" system. Instant jump is the ability of a laser disc player to search up to 200 frames instantly, without any screen blanking. See FIELD KICKING; SCREEN BLANKING.

INTERACTION: A reciprocal dialogue between the user and the system; interactivity (adj., interactive).

INTERCHANGEABILITY: A videodisc design strategy that includes information readable on consumer, industrial and computer-controlled systems.

INTERLACE: In NTSC video, half of the horizontal scanning lines are laid down, and after retrace, the other half are laid down in such a manner as to fall in between.

INTERMEDIATE MATERIALS: All media selected for assembly onto the videodisc premaster, e.g. 16mm film, videotape, 35mm slides, etc.

ISD: Instructional System Development. This is a term for a number of systems which organize the process of developing instruction. ISD is based on general systems theory.

Glossary

JAGGIES: Jaggies are a tearing phenomena around the edges of NTSC images. Research at MIT has effectively solved this problem, and by so doing has created a new way of thinking about displays, computer graphics and NTSC video. See **SOFT FONT**.

KEYER: A keyer cuts a hole in the background video and fills in the hole from a different video source, i.e., computer generated text and graphics keyed over NTSC video. See **VIDEO REPROCESSING, OVERLAY**.

LANDING PAD: A range of frames within which a player can locate a frame or frame sequence. Landing Pad (LPD) is also a command that modifies the number of times a player attempts to locate a frame following an unsuccessful search.

LANGUAGE: A format that allows a programmer to communicate more efficiently with a computer where commands will give requested actions. BASIC is one of the more popular computer languages.

LEARNER CHARACTERISTICS: The knowledge, skills and attitudes of the people who will be using the instruction. Learner characteristics might include age, educational background, reading level and prior training in related areas.

LEVEL OF INTERACTIVITY: The potential for interaction prescribed by the capabilities of videodisc hardware and software.

LEVEL ONE: A videodisc player with still/freeze frame, picture stop, chapter and frame addressability and dual-channel audio, but with no programmable memory.

LEVEL TWO: An industrial/educational model videodisc player with limited programmable memory. On-board memory is programmed from "digital dumps" contained in audio channel two of a videodisc or manually from a keypad.

LEVEL THREE: Any videodisc player interfaced to an external computer. The videodisc player is essentially a computer peripheral.

MAINFRAME: Large computer that is capable of processing large amounts of data at very fast speeds with access to billions of characters of data.

MASTERING: A real-time process in which the premaster videotape is used to modulate a laser beam onto a photosensitive glass master disc.

MODEM: MOdulator-DEModulator. A device that converts data into signals transmitted over communication lines.

MONITOR: An electronic device similar to a television. Receives and displays a non-broadcast video signal sent across wires within a closed circuit but which can not intercept a broadcast signal. Another name for the computer screen.

MOUSE: An input device containing a ball-like element. When moved about a flat surface, the motion and direction of movement is transformed into X-Y coordinates for the display cursor.

NEEDS ANALYSIS: A procedure for determining whether there is a problem; if so, what the problem is; and what steps are appropriate for solving the problem. A needs analysis determines what should be taught in order to achieve specified goals.

NTSC VIDEO: The American television standard set at 525 lines by the National Television Standards Committee.

OBJECTIVES: A precise statement of intent. Objectives are more specific than goals and are stated in terms of learner output. See **GOALS**.

OPTICAL DISC: A videodisc that uses a light beam to read information from the surface of the disc.

OPTICAL MEMORY: Digital data encoded on an optical disc used for mass data storage. It is estimated that one side of an optical disc could store up to 10 billion bits.

Glossary

OVERLAY: A term used to describe the keying of the computer generated text/graphics onto NTSC video.

PAL: Phase Alternate Lines. The standard video set at 625 lines.

PICTURE STOP: An instruction encoded in the vertical interval on the videodisc to stop the videodisc player on a predetermined frame.

PIXELS: A single point illumination on a display device.

PORT: A socket at which cables connecting the computer and its peripherals are attached.

POST PRODUCTION/PREMASTERING: Sometimes called "video processing," this is the process of assembling, editing, coding, evaluating and revising of intermediate materials. The premaster video tape contains all audio/visual information necessary for mastering.

PREPRODUCTION: All design tasks, e.g. flowcharting, storyboarding, scriptwriting, software design, etc., prior to media production.

PREREQUISITES: Any prior knowledge which the learner must have in order to understand and assimilate the information to be learned.

RCA: A videodisc system that uses capacitance signals which are embedded in the grooves on the disc. A "stylus" touches the surface of the disc to read the encoded information.

REFLECTIVE (OPTICAL) DISC: A designation by which the laser beam reads data encoded on an optical videodisc. In the case of a reflective disc, the laser beam is reflected off the shiny surface on the disc.

REINFORCEMENT: A form of feedback which reinforces a learner's correct response. See **FEEDBACK**; **REMEDATION**.

REMEDATION: A form of feedback which re-teaches information of which the learner has demonstrated a lack of understanding. See **FEEDBACK**; **REINFORCEMENT**.

RGB: Red, Green, Blue--standing for the separate input of the signals corresponding to the primary color "guns" in a color cathode ray tube (CRT).

SCAN: To traverse the surface of the disc with video displayed.

SCREEN BLANKING: A variable interval of time in which video is turned off while the disc player searches from one point to another on the disc. See **BLANKING**.

SCRIPT: The document which describes all the elements which will make up the final videodisc, including audio, still and motion video, computer text and graphics, overlays and branching.

SEARCH: To rapidly access a single frame or sequence of frames on a disc with video off.

SEQUENCE: Two or more frames forming one unit, e.g., motion sequence, still frame sequence.

SIMULATION: An instructional program which imitates real life circumstances to help learners build mental models of how to act in real life situations. They generally involve higher order skills such as synthesis, evaluation and problem solving. See **DRILL** and **PRACTICE**; **GAME**; **TUTORIAL**.

SLOW MOTION: In videodisc technology, the controlled movement of the laser from frame to frame at a variable rate less than 30 frames per second.

SME: Subject Matter Expert. The person who serves as content expert through all phases of videodisc development.

SMPTTE: Society of Motion Picture and Television Engineers.

SOFT FONTS: A grey level scheme developed by MIT for high quality fonts in NTSC video adding legibility, removing scintillation, and enhancing encodability, which results in over eighty characters per line on a color television receiver.

Glossary

STEP: To advance one frame forward or reverse.

STILL FRAME: Still material, including photographs, line drawings, pages, etc., designed and presented as a single videodisc frame.

STILL FRAME AUDIO (SFA): Sometimes called "compressed audio," still-frame audio describes a method digitally encoding and decoding several seconds of voice quality audio per individual disc frame, resulting in a potential for several hours of audio per disc.

STORYBOARD: A corollary to the script. Whereas the script describes scenes verbally, the storyboard gives a graphic depiction of what the visual should look like. Depending on individual circumstances, a storyboard may or may not be used. See **SCRIPT**.

SUMMATIVE EVALUATION: An evaluation conducted after a product is completed in order to make decisions about its effectiveness. See **FORMATIVE EVALUATION**.

TASK ANALYSIS: An analysis of the information to be taught in order to determine content, sequence and prerequisites. A task analysis will also reveal how segments relate to one another, as well as to previous knowledge, and whether segments need to be taught in a specific order.

THREE-TWO (3-2) PULLDOWN: A means of compensating film shot at 24 frame per second with video 30 frames per second. The first film frame is actually exposed on 3 video fields and the next film frame is exposed on 2 fields.

TRANSMISSIVE DISC: A designation of the means by which the laser beam reads data encoded on an optical videodisc. In the case of the transmissive disc, the laser beam passes through the transparent surface of the disc.

TREATMENT: A design document which describes in general terms the scope and sequence of the instruction.

TUTORIAL: An instructional program which presents new information to the learner in an efficient manner. It generally involves some questioning, branching and options for review. See **DRILL** and **PRACTICE**; **GAME**; **SIMULATION**.

VERTICAL BLANKING INTERVAL (VBI): Twenty-one blanked lines during field 1 and 21 blanked lines during field 2 wherein frame numbers, picture stops, chapter codes, white flags, closed captions, etc. are encoded.

VERTICAL INTERVAL TIME CODE (VITC): A derivative of the Society of Motion Picture and Television Engineers (SMPTE) time code that is stored in the vertical blanking interval.

VHD: A Video High Density (VHD) disc system, developed by JVC is a stylus playback system. Information signals are recorded in micro pits of the grooveless disc. The electrode (narrower than the information track) which picks up the signal from the micro pits, is attached to a diamond stylus. A tracking servo guides the stylus along the surface, tracing the tracks as well as removing dust and shaving small defects off the disc's surface.

VIDEO REPROCESSING: The process of keying video from the computer over NTSC video.

WHITE FLAG: A code that identifies a new film frame (shot at 24 fps). During premastering, the code is inserted on the first video field, which in turn enables the videodisc player to jump back to the previous two fields, resulting in a fully matched freeze frame (without flicker).

WORM: Write Once Read Many

Editors and Contributing Authors

Lt. Colonel Duane E. Bright (Phd, The Ohio State University)

USAFA/DFP

USAF Academy, CO 80840

(719) 472-3820

FAX: 472-3135

Internet: bright@usafa.af.mil

Lt. Colonel Bright is Professor of Spanish at the United States Air Force Academy. Having taught at the Air Force Academy since 1977, he has been chairman of the Academy's Spanish Division and is currently Deputy Head and Deputy for Academics for the Department of Foreign Languages. As Deputy for Academics he is responsible for the Academy's entire foreign language curriculum: course development, testing, and faculty assessment.

Lt. Colonel Michael D. Bush (Phd, The Ohio State University)

USAFA/DFP

USAF Academy, CO 80840

(719) 472-3820

FAX: (719) 472-3135

Internet: bush@usafa.af.mil

Lt. Colonel Bush has been involved in programming different computers in various ways and using them to solve diverse problems over the past 22 years. He has a very wide range of experience in the uses of high technology in education. From 1980 to 1984 he served as Director of Research in the Department of Foreign Languages at the United States Air Force Academy (USAFA). He has been a prime leader in the Academy's installation of what is probably the first operational interactive videodisc-based language learning center of its kind and size on any college campus in the world. After being appointed a Tenure Associate Professor of French in 1984, he served a sabbatical in Paris, France, with NATO's Advisory Group for Aerospace Research and Development (AGARD) where he was responsible for upgrading AGARD's office automation systems. At the present time, Lt Col Bush is serving as Tenure Professor of French and Deputy for Research in the Department of Foreign Languages at USAFA. He is also the Chairman of the Academy's Tenure Council's Working Group on Technology in Education, a committee charged with laying out USAFA's plans for future implementations of technology in the educational process.

Kuan-Yi Rose Chang (Phd, Purdue University)

Department of Foreign Languages

West Virginia University

205 Chitwood Hall

Morgantown, WV 26506\

(304) 293-5121

FAX: (304) 293-7655

Dr. Chang is Assistant Professor of TESL/Foreign Language Methodology and Director of Computer Assisted Language Learning Laboratory at West Virginia University, where she also coordinates the ESL curriculum and teaches Spanish and topics in ESL and Foreign Language Education. She is a member of ACTFL, TESOL, CALICO and IALL (International Association of Learning Laboratories).

Editors and Contributing Authors

Colonel Ruben A. Cubero (Phd, The University of Denver)

USAFA/DFF

USAF Academy, CO 80840

(719) 472-2103

FAX: 472-3135

Internet: cubero@usafa.af.mil

Colonel Cubero is a permanent professor and head of the Department of Foreign Languages at the United States Air Force Academy. He earned his Phd in Education from the University of Denver in 1983. In addition to his years of military service, he has taught Spanish at the Air Force Academy since 1972, where he also serves as the faculty representative to the National Collegiate Athletic Association. During the Academic Year 1990-91 he is on Sabbatical serving as Project Director of the German Language Multimedia Project, an innovative interactive videodisc development effort between the Federal and private sectors under the Technology Transfer Act of 1986.

Catherine Doughty (M.S., Phd, University of Pennsylvania)

Department of Linguistics, University of Sydney

NSW 2006 Australia

Internet: Catherine-Doughty@linguistics.au.oz.au.

Dr. Doughty's interests include second language acquisition theory and research and computer-assisted language learning. Working at the Language Project at the University, she participated in the development of several technology-based tools for language professionals as well as in research in applications of technology to language education. She has just begun a year-long research project investigating cognitive and environmental factors in second language acquisition.

Mylène Garrigues

Centre International d'Etudes Pédagogiques

1 Avenue Léon Journault

92311 Cedex

Sèvres, France

Madame Garrigues is the director of training and research on the use of emerging technologies in the teaching and learning of languages for the Center of International Pedagogical Studies in Sèvres, France (Centre International d'Etudes Pédagogiques, Sèvres, France). At the World Center for Informatics and Human Resources, she worked with videodisc pioneer Georges Broussaud on various interactive videodisc applications, including the Peau d'Ane prototype. She has done a great deal of work throughout Europe, lecturing and presenting workshops for various institutions in the European Community.

Joel D. Goldfield (Phd, Université de Montpellier III: Université Paul Valéry)

2203 Sprunt Avenue

Durham, NC 27705

(919) 286-5956

FAX: (919) 684-3200

Internet: joel@lambda.acs.unc.edu

Dr. Goldfield is Associate Professor of French at Plymouth State College (NH) and chief CALL consultant for the Language Outreach Program at Dartmouth College. He is an Assistant Editor for *Computers and the Humanities*. His annotated, software-based bilingual readers of two tales by Guy de Maupassant were recently published by Transparent Language.

A 1990-91 Visiting Scholar at Duke University and Fellow in Foreign Languages at UNC-Chapel Hill's Institute for Academic Technology, Dr. Goldfield assisted at Duke in the conceptualization, design and testing of WinCALIS, a foreign language application (mini-authoring) system with IVD capability. He is now developing French IVD courseware. At the IAT, Dr. Goldfield is creating a literary scholar's multimedia, AIX-Windows workstation with querying tools for concept analysis and stylo-statistical research.

Editors and Contributing Authors

Carla Meskill (Ed.D, Boston University)
University of Massachusetts at Boston
Harbor Campus
Boston, MA 02125-3393
(617) 287-5760

Dr. Meskill is director of the Interactive Video Language Laboratory at the University of Massachusetts at Boston. In addition to CALL/IVD materials development, she teaches graduate courses in instructional design, classroom computer applications and second language teaching methodology.

Allen Rowe (MA, Université de Paris)
Interactive Language Instruction and Development (ILIAD)
22568 Veronica Drive
Salinas, CA 93908-1125
(408) 484-2647
Internet: iliad@mcimail.com

Allen Rowe earned an MA in French as a Fulbright scholar in Paris, served as Chair of French at the U.S. Air Force Academy and instructor of English at the French Air Force Academy. He founded language technology operations at the Defense Language Institute and the Monterey Institute of International Studies. He is currently president of his own company, Interactive Language Instruction and Development (ILIAD)

Alice Slaton (Phd, The University of California, Los Angeles)
Ventura College
4667 Telegraph Road
Ventura, CA 93003
(805) 642-3211, ext. 1391

Alice Slaton is the former Journal Representative for CALICO's Interactive Audio/Video Special Interest Group (SIG), one of the editors and authors of the CALICO Interactive Audio/Video Monograph; and the Journal representative for CALICO's Hypercard SIG. She has given various presentations on interactive video and language teaching and has written articles for various publications on technology and languages. She has participated in an interactive video pilot project at Brigham Young University and developed the interactive videodisc Interactions Audio-Visuelles. With a small grant from the Fund for Instructional Improvement from the State of California, she has developed interactive video software using a Macintosh II Interactive Video Desktop Publishing Station at Ventura College. She is now the main teacher of the Basic Workshop on Interactive Video for the Sony Institute. She has produced the audio cassette *Discover What Makes the French French* and is now publishing the book version of the cassette. She is currently planning to design, develop and produce a laser videodisc on the French culture and language to include Francophone Africa, Quebec, the Society Islands and France.

Martha E. Slayden (MA, The University of Colorado)
Air Academy High School
USAF Academy, CO 80840
(719) 472-1295

Ms. Slayden received her BA in French and Spanish from The Colorado College in 1978 and her MA in Education from the University of Colorado in 1989. She has taught French and Spanish at Air Academy High School in Colorado Springs, CO since 1979. In 1990-91 she is serving as a Research Associate at the United States Air Force Academy, where she is involved with studies in computer-assisted language acquisition.

Editors and Contributing Authors

Wm. Flint Smith (Phd, Purdue University)
Syracuse University Center in Spain
Instituto Internacional
Miguel Angel, 8, Despacho 110
28010 Madrid, Spain
(341) 319-99-42
FAX: (341) 319-09-86

Dr. Smith is Academic Chairman and Professor of Spanish for Syracuse University Division of International Programs Abroad in Madrid, Spain. Recipient of the Paul Pimsleur Award for Research in Foreign Language Education (1979), he was the 1985-86 Distinguished Visiting Professor in Language at the United States Air Force Academy. In 1987-88 he edited for ACTFL two volumes of essays on CALL and CALL-related topics (*Modern Media in Foreign Language Education: Theory and Implementation*, 1987, and *Modern Technology in Foreign Language: Plans and Projects*, 1988) published by National Textbook Company, Lincolnwood, IL. He also serves on the Editorial Board for the *Modern Language Journal*.

John Underwood (Phd., University of California, Los Angeles, 1981)
Department of Foreign Languages
Western Washington University
Bellingham, WA 98225
(206) 678-3918

Dr. Underwood, Associate Professor of Spanish and Linguistics at Western Washington University (Bellingham), is well-known as both an innovator and a critic in the field of computer-assisted languages learning. His CALL projects include JUEGOS COMUNICATIVOS, problem-solving games: CORREO, a Spanish electronic mail system for communication and composition; and Alexis, a multi-activity system for French, Spanish, and German at Mills. He is currently developing Spanish video software for Random House Publishers. Among his publications, the best-known is *Linguistics, Computers, and the Language Teacher: A Communicative Approach* (Newbury House, 1984). He is the winner of the 1985 Mildenerger Medal of the Modern Language Association.

Lt. Colonel Miguel Verano (Phd, the University of Texas)
USAF A/DFF
USAF Academy, CO 80840
(719) 472-2840
FAX: 472-3135
Internet: verano@usafa.af.mil

Lt. Colonel Verano began teaching Spanish at the United States Air Force Academy in 1983 and earned his Phd in Foreign Language Education from the University of Texas in 1987. Lt. Colonel Verano helped to create and build the Air Force Academy's interactive videodisc-based Language Learning Center and has published in numerous scholarly journals on the subject of IVD courseware development. He has served in the Air Force for over 19 years.
